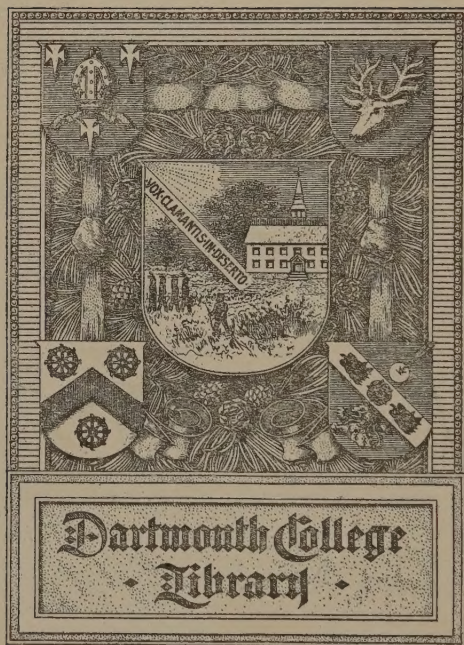




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The Mammals of Colorado

An account of the several species found within
the boundaries of the State, together with
a record of their habits and of
their distribution

By

Edward Royal Warren, S.B.

Director of the Museum of Colorado College

*With three maps and a full series of illustrations reproduced
from photographs taken from nature*

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1911

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The Knickerbocker Press, New York

To

WILLIAM LUTLEY SCLATER, M.A., F.Z.S.

REALLY A COLLABORATEUR IN THE WORK, THIS BOOK IS DEDICATED IN
APPRECIATION OF A FRIENDSHIP AND ASSOCIATION
TO WHICH I OWE MUCH

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INTRODUCTION

AN apology seems hardly necessary for the issue of this book, for any one who takes any interest in Nature feels the need of a book treating of the local species of animals or plants, and such a book is entirely wanting for Colorado mammals. Whatever information we have concerning these is scattered through many and various publications, mostly issued by the Government, and which are often out of print or inaccessible to the average student.

A few words of acknowledgment and explanation with regard to the work on this book will not be amiss. Some three years ago, Mr. William Lutley Sclater, then Director of the Museum of Colorado College, began a book on the mammals of Colorado, but dropped it to take up other work. A little later he turned his manuscript over to me with the urgent solicitation that I take it up and complete it. Between the time when Mr. Sclater began and I took hold, a number of species had been added to the Colorado fauna, and as more specimens were available from which to draw up the descriptions, it was necessary to rewrite most of the portion which was at that time prepared, as well as to compose the remainder. But during all the time I was at work on this I had the willing and unfailing advice of Mr. Sclater, and he was also good enough to write the diagnoses of the orders, families, and many of the genera, and also drew up the keys of the families and genera, and he likewise read over and revised the whole manuscript. I cannot express how much I owe to him, but I would hardly have ventured upon the work without his assistance and co-operation.

Most of the descriptions of the species have been made from Colorado specimens in my collection; a number of others were taken from specimens kindly loaned for the purpose by Dr. C. Hart Merriam, Chief of the Biological Survey of the U. S. Department of Agriculture. I am also indebted to him for aid in many points, such as identifying specimens and answering innumerable questions regarding matters which came up from time to time. Messrs. E. W. Nelson, Vernon Bailey, and W. H. Osgood of the Biological Survey have also been kind in answering queries put to them in their departments. Messrs. W. C. Ferrill and H. G. Smith, Curator and Assistant Curator respectively, of the State Historical and Natural History Society at Denver, have allowed me to examine and describe specimens in their charge. V. H. Borchardt, Chief Taxidermist, and L. J. Hersey, of the Department of Ornithology, of the Colorado Museum of Natural History, Denver, have allowed me access to specimens and notes in their care, belonging to the "Carter Collection," which were especially useful in giving Colorado data not otherwise attainable. Many other friends have also aided in various ways. Some of the descriptions have been taken from various books, credit for them, usually at least, being given in the individual cases.

Robert B. Rockwell and Herman W. Nash have generously permitted the use of photographs taken by them of certain species, which are duly credited in the proper places. I also wish to acknowledge the permission kindly given by Mr. Junius Henderson, Curator of the Museum of the University of Colorado at Boulder, to use certain records obtained in Rio Blanco County by an expedition under his charge in the summer of 1909.

While there is already a long list of mammals for our State, it is not at all unlikely that it may be added to; and even if this is not the case, there is yet much to be learned as to the

habits and distribution of most of the species. The incompleteness of such data offers a fine opportunity for local work.

The measurements are all given in inches and hundredths, unless otherwise stated, as this system was deemed more useful and intelligible to the lay reader than that of millimetres, which are used in scientific writings. A few words as to the measurements may not be amiss. The measurements commonly taken of a mammal are: The total length from the tip of the nose to the end of the tail vertebræ (*not to the end of the hairs*); tail vertebræ, from the root of the

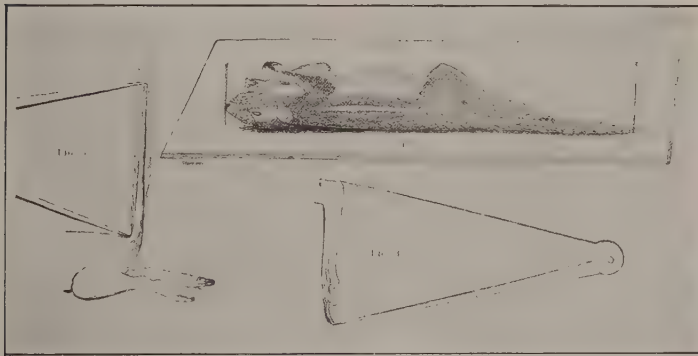


FIG. 1. MEASURING A MAMMAL

Fig. 2, total length; Fig. 3, tail vertebræ; Fig. 4, hind foot.—*After Merriam*

tail to the end of the vertebræ; hind foot, from the heel to the end of the longest toe of the hind foot; in some cases, such as a rabbit, the length of the ear from the notch to the tip is also often useful; and in bats the length of the forearm is a valuable point and often absolutely necessary. The plate shows the method of taking the three first named in a small mammal. The measurements should always be taken in the flesh before skinning.

DIRECTIONS FOR SKINNING MAMMALS FOR SCIENTIFIC
PURPOSES

The following directions tell how a mammal should be skinned for scientific purposes, and the skin preserved so that it can be made up into a museum skin at any future time. It has not been thought best to give full directions for the making up of skins, such can be found in any good modern book on taxidermy (Rowley's *Art of Taxidermy* is very good), and the Biological Survey has published a circular giving directions which may be had for the asking.

To skin mammals for scientific purposes make the opening cut along the middle of the belly from about the end of the breast-bone to the root of the tail. Do not cut through the walls of the body cavity if such cutting can possibly be avoided. Press the skin away on one side of the cut (sprinkling on corn-meal if necessary, to keep the blood from staining) until a hind leg is exposed. Either cut the leg-bone with a pair of scissors, or, if the animal is too large or scissors are not at hand, cut apart at the knee-joint. Cut through all the flesh so that the leg is entirely freed from the body.

Turn your attention to the other side and proceed in the same manner. Then work the skin away from around the tail and remove the bone from the tail, usually quite an easy matter. In the case of a small mammal it is not difficult to pull out the bone, if one grasps it between the thumb and fore-finger nails. In the case of larger mammals, two pieces of wood held one on either side of the tail-bone may be necessary, also cutting and working a little until the bone begins to slip, when it will pull out with little trouble. If blood is inclined to flow, sprinkle corn-meal liberally.

Turn the skin back over the body, inside out, taking care not to stretch it. When the forelegs are reached, disjoint or cut at the shoulder. Continue skinning over the head,

being careful in cutting about the ears and eyes, and skin the head clear out. Detach the skull from the body by cutting the flesh around the neck close to the back end of the skull; the head can usually then be twisted off; if not, cut it, but *be careful not to injure the skull*. Tie a tag to the skull, numbered to correspond with the skin.

Skin the legs out down to the feet, and remove the flesh from the bones, leaving the bones attached to the skin. Put a wire in the tail (galvanized or tinned iron is best if the skin is to be salted, as it does not rust or corrode); file it to a point, if necessary, so that it may go clear to the end of the tail. Tie a tag showing sex, date, locality, and measurements taken according to accompanying directions, to a hind leg. Rub some salt on the flesh side of the skin, turn it right side out, and let it lie that way for twenty-four hours or so, then turn wrong side out again, and let dry in that way, without stretching or "casing" it in any manner. *Do not dry skins in the sun.*

If the mammal is a small one, it is not necessary to cut off the flesh adhering to the skull before drying the skull. If the mammal is a large one, cut off the thickest flesh on the cheeks and between the jaws, take out the tongue, and then dry the skull. It is best to number skull labels on both sides to avoid the risk of defacing which may result if the marked side of the label sticks to the skull. In fly time, it is best to protect skulls from flies in some way.

Use this sign, ♂, for males, and ♀ for females on labels.

Small mammals can be skinned with a small-bladed knife, but a small pair of scissors are very handy. Small galvanized wire can be obtained by cutting off a piece of wire clothes-line and untwisting, and also from small wire rope. Most hardware stores keep tinned wire on small spools. Fine sawdust or sand will do instead of corn-meal for absorbing blood.

Skins treated in the above manner can be easily softened and turned and made up into museum skins at leisure, but it is of course best to do this on the spot if one knows how, and has the opportunity.

While this book has been in the printer's hands Professor T. D. A. Cockerell of the University of Colorado has written me concerning some investigations made by one of his students upon the anatomy of certain genera, and which show some interesting differences in the relative lengths of the large and small intestines. In *Cratogeomys* the large intestine was always the longer, and the reverse the case in *Perodipus*. Other similar facts were found in *Peromyscus b. rowleyi*, *Onychomys l. pallescens*, and *Thomomys agrestis*. These investigations were made upon material saved by myself during the past season in various collecting trips, and was mostly the carcasses of specimens which I had skinned, and which I had preserved in alcohol at Professor Cockerell's request, and which would otherwise have been thrown away.

I mention this in this connection because it shows there is a field for original work upon the anatomy of our mammals, and the material is easily obtained by saving the bodies of such specimens as are skinned, or the whole animal if the skin is not desired. Specimens for this purpose can be preserved in alcohol, either common or denatured; ten to twenty per cent. of water should be added to the alcohol; or formaldehyde may be used instead of alcohol, using one part of formaldehyde as sold in the drug-stores to ten or fifteen parts of water. Glass preserve jars are just the thing for holding the specimens. Whole unskinned specimens should have a short cut made in the skin of the belly to admit the preservative. Each specimen should have a label stating what it is, and other necessary data, and this should be written in pencil, or some form of India ink. Any of Higgins' black inks are good. *But never use common writing ink on a label which is to go into alcohol or formaldehyde as the writing is almost certain to be obliterated.* Always use heavy writing paper for the label, never a cardboard label, *that goes to pieces when wet.* If the specimens are to be transported far it is well to wrap each in a piece of cheese-cloth or something of the sort to prevent too much rubbing together and destruction of labels. If collectors will do this and turn the material over to interested persons they will aid much in advancing our knowledge concerning our mammals, and at but little trouble to themselves.

LIFE ZONES

BOTH physical geographers and naturalists divide the earth into life zones, from the Boreal Regions to the Tropics; and in the latter, in the mountainous portions, there is a corresponding division from the bases to the summits of the mountains, where, if the latter are sufficiently lofty, we have animals and plants representing the Arctic fauna and flora. It naturally follows that in the intermediate regions the different zones are also represented on the mountain sides. The distribution of animals and plants depends on temperature, and Dr. Merriam has demonstrated that "the northward distribution of terrestrial animals and plants is governed by the sum of the positive temperatures for the entire season of growth and reproduction, and that the southward distribution is governed by the mean temperature of a brief period during the hottest part of the year." He has divided the United States into Boreal (Northern), Austral (Southern), and Transition (Intermediate) climates, fauna, and flora. These are further subdivided into the following life zones: Arctic or Alpine, Hudsonian, Canadian, Transition, Upper Sonoran, Lower Sonoran, and Tropical. In Colorado we have the first five named zones, and possibly a very little Lower Sonoran in the lowest portions of western Colorado.

The Alpine Zone is above the tree limit or timber-line which in Colorado is at about 12,000 feet or a little less. It is characterized by dwarf shrubs and plants. In Colorado there are no characteristic mammals, though in the Arctic regions there are the Polar Bear, Arctic Fox, and Reindeer.

We have records of about ten species of mammals from this zone, and there should be more. Among the birds Ptarmigan, Brown-capped Leucosticte, and Pipit are practically restricted to it in the breeding season.

The Hudsonian is, in Colorado, the region from about 10,000 feet up to timber-line; it is the upper portion of the timbered belt of the mountains, characterized by Engelmann's spruce and white fir for the trees. The mammals most characteristic are the Pine Marten, Wolverine, Canada Lynx, and Snow-shoe Rabbit, though all these, the latter especially, may range into the zone below, the Canadian. The voles of the genus *Phenacomys* also range up into it. The Cony or Pika is found here, but also in the zones above and below. The Rocky Mountain Jay or Camp Bird is a very characteristic bird.

The Canadian Zone is from 8,000 feet up to 10,000 feet, the lower part of the coniferous forests, with the upper part of the aspens. The animals named above under Hudsonian range in much of it, also two or three species of *Microtus*, and various long-tailed Shrews (*Sorex* and *Neosorex*).

The Transition Zone in our State is from a little under 6,000 up to 8,000 feet, part of the plains and all the foothill region. Here is found the yellow pine (*Pinus scopulorum*); the aspens first make their appearance in this zone; various species of cottonwoods are found in it, as also junipers ("cedars") and piñons, and scrub-oaks and various other trees and shrubs. As its name would imply, it is intermediate or transitional between the zones above and below, and its fauna and flora are rather a mixture than specially characteristic, so that it is difficult to define it by any species. Among mammals *Sciurus aberti* and its subspecies, *Callospermophilus wortmani*, *Eutamias minimus* and *E. m. caryi*, and *Peromyscus nasutus* are confined to this zone, while Prairie Dogs, Black-tailed Jack Rabbits, Grasshopper Mice, *Peromys-*

cus truei, *P. rowleyi*, and *P. auripectus*, *Neotoma fallax*, and *N. arizonæ* are all found in this zone, as well as in the zone below.

In Colorado the Upper Sonoran Zone is that portion of the State lower than say 5,800 feet; it covers most of the plains region, and also a certain amount of rather rough country in the southern and western parts of the State. In the dry regions the greasewood (*Sarcobatus*) is found, also various cacti not found higher up, while it shares the sage-brush (*Artemisia*), junipers, and piñons with the Transition. Among our mammals *Geomys lutescens*, *Cratogeomys castanops*, *Perognathus paradoxus*, *Citellus obsoletus*, *C. s. major*, *Peromyscus tornillo*, *Reithrodontomys nebrascensis*, *Neotoma baileyi*, *N. micropus*, *N. alb. warreni*, *N. desertorum*, *Antrozous pallidus*, *Pipistrellus hesperus*, *Nyctinomus depressus*, and *N. mexicanus* seem at present to be confined to it, while various other species are shared with the Transition, to say nothing of those which range into the zones above that.

It should be stated that it is almost impossible to define exactly the limits of any of these zones, except perhaps the Arctic-Alpine. The most reliable data is afforded by the flora, as plants do not have the power of movement that animals have, and are also in many cases much more susceptible to climatic influences. On the other hand many of our birds and mammals are found in several zones. We have in Colorado three species of mammals which are found in every zone from Upper Sonoran to and including the Alpine. Many others are found in three and four of the zones, so that it will be seen that, on the whole, these forms do not specially characterize any one zone as a rule. Of course all have their limits, above or below which they seldom or never go, yet occasional individuals do wander surprisingly at times.

BIBLIOGRAPHY

In this Bibliography are given the most important papers relating to Colorado mammals, including those containing the descriptions of species whose type locality is in this State, and accounts of the habits of Colorado species. A number of papers and books, principally publications of the Biological Survey, which, while having no special Colorado references, have some very good accounts of the habits of species which do occur in our State, or of closely related species, and of their economic relations, have been included. One or two strictly technical papers have also been included for the benefit of those who may wish to look further into those matters. Many articles have been published in sporting magazines having reference to Colorado mammals. These would be entitled to a place in a complete bibliography, but it has not been deemed necessary to print their titles here.

ALLEN, J. A. History of the American Bison, *Bison americanus*. 9th Annual Report, U. S. Geol. & Geograph. Sur. of Territories, for 1875. F. V. HAYDEN, U. S. Geologist, Washington, 1877. A very good account of the history of the Buffalo up to that date. It is a reprint of an article which appeared in the report of the Geological Survey of Kentucky, and was also published by the Museum of Comparative Zoölogy, Cambridge.

ALLEN, J. A., and ELLIOTT COUES. United States Geological Survey of the Territories. Monographs of North American Rodentia. Washington, 1877. Many specimens of various species are noted from Colorado localities in the various monographs which go to make up the work.

ALLEN, J. A. Descriptions of Four New Species of *Thomomys*, with Remarks on Other Species of the Genus. Bull. Amer. Mus. Nat. Hist., v., pp. 47-68. 1893. Contains description of *Thomomys fossor* from type taken at Florida, La Plata County.

ALLEN, J. A. List of Mammals Collected by Mr. Charles P. Rowley in the San Juan Region of Colorado, with Descriptions of New Species. Bull. Amer. Mus. Nat. Hist., v., pp. 69-84. 1893.

- ALLEN, J. A. Descriptions of Ten New North American Mammals, and Remarks on Others. Bull. Amer. Mus. Nat. Hist., vi., pp. 317-332. 1894. Contains description of *Neotoma campestris* (now *N. floridana baileyi*) type from Pendennis, Lane County, Kan., and mentions a specimen taken by Capt. P. M. Thorne at Fort Lyons, Colo.
- ALLEN, J. A. On the Species of the Genus *Reithrodontomys*. Bull. Amer. Mus. Nat. Hist., vii., pp. 107-143. 1895. Contains description of *R. dychei nebrascensis* from type from Kennedy, Nebraska, and notes specimens from Cañon City and Loveland, Colorado. Also speaks of *R. montanus* Baird, and shows that the type probably came from the San Luis Valley, Colorado.
- BAILEY, VERNON. U. S. Dept. of Agriculture, Div. of Ornithology & Mammalogy. Bull. No. 4. The Prairie Ground Squirrels of the Mississippi Valley. Washington, 1893. Refers to the occurrence of different *Spermophiles* in Colorado.
- BAILEY, V. Revision of the American Voles of the Genus *Eutamias*. Proc. Biol. Soc. Wash., xi., pp. 113-138. 1897.
- BAILEY, V. The Pocket Gophers of the United States. Bull. No. 15, Div. of Ornithology and Mammalogy, U. S. Dept. of Agriculture. 1895.
- BAILEY, V. North American Fauna, No. 17. Revision of the American Voles of the Genus *Microtus*. 1900. Gives Colorado references and records of various species.
- BAILEY, V. North American Fauna, No. 25. Biological Survey of Texas. 1905. While it contains no Colorado references there are many good accounts of the habits of various species which are found in Colorado.
- BAILEY, V. Wolves in Relation to Stock, Game, and the National Forest Reserves. Forest Service Bulletin, No. 72. 1907. Good accounts of the habits of the large wolves in the West.
- BAILEY, V. Harmful and Beneficial Mammals of the Arid Interior, with Special Reference to the Carson and Humboldt Valleys, Nevada. U. S. Dept. of Agriculture, Farmers' Bulletin, No. 335. 1908. Very good accounts of the economic relations of certain species, which species or related forms of which are found in Colorado.
- BAILEY, V. Destruction of Wolves and Coyotes. Results obtained in 1907. Biological Survey Circular, No. 63. 1908. Notes

as to the result of work against these animals in various States, statistics, etc.

BAIRD, S. F. Exploration and Survey of the Valley of the Great Salt Lake, of Utah, including a Reconnaissance of a New Route through the Rocky Mountains. By Howard Stansbury, Captain Corps of Topographical Engineers, U. S. Army. Philadelphia, 1852. Appendix C, Zoölogy. Mammals by Spencer F. Baird. Contains description of *Pseudostoma* (now *Cratogeomys*) *castanops*. Type collected by Lieut. Abert, near Bent's Fort, Colorado.

BAIRD, S. F. Characteristics of Some New Species of North American Mammals, Collected Chiefly in Connection with the U. S. Surveys of a Railroad Route to the Pacific. Proc. Acad. Nat. Sci. Phila., vii., pp. 333-336 (1855). Contains descriptions of *Cynomys gunnisoni* from Cochetope Pass, and *Perodipus montanus* from the San Luis Valley in Colorado, these being the original descriptions in each case.

BAIRD, S. F. Reports of Explorations and Surveys to Ascertain the most Practicable and Economical Route from the Mississippi River to the Pacific Ocean. Made under the Direction of the Secretary of War in 1853-1856, According to the Acts of Congress of March 3, 1853, May 31, 1854, and August 5, 1854. Vol. viii. Washington, 1857. (The Mammals of North America.) Describes *Microtus modestus* from Saguache (Cochetope) Pass, Colorado.

BANGS, OUTRAM. Descriptions of Two New Pikas from Western North America. Proc. New England Zoölogical Club, i., pp. 39-42. 1899. Describes *Ochotona saxatilis* from Snowy Range, Montgomery, Park County, Colorado.

CARY, MERRITT. Some Unrecorded Colorado Mammals. Proc. Biol. Soc. Wash., xx., pp. 23-28. 1907. Records for the first time the occurrence in Colorado of a number of species.

CARY, M. A Colorado Record for *Callospermophilus wortmani*, with Notes on the Recent Capture of *Antrozous pallidus*. Proc. Biol. Soc. Wash., xx., pp. 85-86. 1907.

COOPER, C. A. The Big Game of North America. Its Habits, Habitat, Haunts, and Characteristics; How, When, and Where to Hunt It. Edited by G. O. Shields. 1890. Includes an article on the Wolverine by C. A. Cooper which gives records of the animal in Colorado.

- COUES, ELLIOTT, and J. A. ALLEN. See J. A. Allen and Elliott Coues.
- COUES, E., and H. C. YARROW. Report on the Collections of Mammals Made in Portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona, during the Years 1871, 1872, 1873, and 1874. By Dr. Elliott Coues and Dr. H. C. Yarrow. Report of U. S. Geogr. Explor. and Sur. West of 100th Meridian. (Wheeler Survey.) Vol. v., chap. ii., pp. 35-129. 1875. A number of Colorado records of various species.
- COUES, E. Fur-bearing Animals: A Monograph of North American Mustelidæ, in which an Account of the Wolverine, the Martens or Sables, the Ermine, the Mink, and Various Other Kinds of Weasels, Several Species of Skunks, the Badger, the Land and Sea Otters, and Numerous Other Exotic Allies of these Animals, is Contributed to the History of North American Mammals. Misc. Pub. No. 8, U. S. Geolog. Sur. of Territories (Hayden). 1877. Contains certain Colorado references.
- COUES, E. List of Mammals in the Maxwell Collection, published as an appendix to Mary Dartt's book, noted later. The first list of Colorado mammals.
- CRAM, W. E., and W. STONE. See W. Stone and W. E. Cram.
- DARTT, MARY. On the Plains and among the Peaks; or How Mrs. Maxwell Made her Natural History Collection. By Mary Dartt. Philadelphia, 1879. Describes Mrs. Maxwell's work, and mentions different mammals in main part of book. Dr. Coues' list is an appendix to this.
- ELLIOT, DANIEL GIRAUD. A Synopsis of the Mammals of North America, and the Adjacent Seas. Zoölogical Series, Vol. ii. (Field Columbian Museum.) 1901. Colorado mentioned as included in the distribution of many species.
- ELLIOT, D. G. A Check List of Mammals of the North American Continent, the West Indies, and the Neighboring Seas. Field Columbian Museum, Publication 105. Zoölogical Series, Vol. vi., Chicago, 1905. Mentions Colorado in distribution of many species. This is the work frequently referred to in these pages as "Elliot's Check-List."
- HORNADAY, WILLIAM T. The Extirpation of the American Bison. Report U. S. Nat. Mus., 1886-7, pp. 369-548, pls. i.-xxii. 1889. A standard work on the subject.
- HORNADAY, W. T. The American Natural History. A Foundation

- of Useful Knowledge of the Higher Animals of North America. 1904. A useful book.
- HOWELL, ARTHUR H. North American Fauna, No. 20. Revision of the Skunks of the Genus *Chincha*. Washington, 1901. This is the genus *Mephitis*. Gives Colorado references and records of various species.
- HOWELL, A. H. Three New Skunks of the Genus *Spilogale*. Proc. Biol. Soc. Wash., xv., pp. 241-242. 1902. Describes *Spilogale tenuis* from type taken at Arkins, Larimer County, Colorado.
- HOWELL, A. H. North American Fauna, No. 26. Revision of the Skunks of the Genus *Spilogale*. 1906. Gives Colorado records of *S. tenuis* and *S. g. saxatilis*.
- LANTZ, DAVID E. Meadow Mice in Relation to Agriculture and Horticulture. Year Book of Department of Agriculture, Washington, 1905. Accounts of habits, directions for destroying, etc.
- LANTZ, D. E. Coyotes in their Economic Relations. Biol. Sur. Bull., No. 20. 1905. Accounts of habits of coyotes, etc.
- LANTZ, D. E. An Economic Study of Field Mice (Genus *Microtus*). Biol. Sur. Bull., No. 31. 1907. Good accounts of their habits, damage done by the mice, etc.
- LANTZ, D. E. The Rabbit as a Farm and Orchard Pest. Year Book of Department of Agriculture. 1907. Special reference to damage done by rabbits to trees and crops.
- LYON, MARCUS WARD, JR. Classification of the Hares and their Allies. Smithsonian Misc. Coll., xlv., pp. 321-447. 1904. Systematic descriptions of the genera of Hares and Pikas.
- LYON, M. W., JR. Remarks on the Horns and on the Systematic Position of the American Antelope. Proc. U. S. Nat. Mus., xxxiv., pp. 393-402. 1908. Very good account of structure and shedding of the horns.
- MACFARLANE, R. Notes on Mammals Collected and Observed in the Northern Mackenzie River District, Northwest Territories of Canada, with Remarks on Explorers and Explorations of the Far North. Proc. U. S. Nat. Mus., xxviii., pp. 673-764. 1905. While it of course contains no Colorado references, it has many good accounts of the habits of various species which do occur in Colorado, or are closely allied to ours.
- MEARNS, EDGAR A. Preliminary Diagnoses of New Mammals of the Genera *Sciurus*, *Castor*, *Neotoma*, and *Sigmodon*, from the Mexican Border of the United States. Proc. U. S. Nat. Mus.,

xx., 1898. Describes *Castor canadensis frondator*, giving Colorado as part of its range.

MEARNS, E. A. Mammals of the Mexican Boundary of the United States. A Descriptive Catalogue of the Mammals Occurring in that Region; with a General Summary of the Natural History and a List of Trees. Part I., Families *Didelphiidæ* to *Muridæ*. Bull. No. 56, U. S. Nat. Mus. 1907. Contains accounts of the habits of certain species which are also found in Colorado.

MERRIAM, C. HART. Abstract of a Study of the American Wood Rats, with Descriptions of Fourteen New Species and Subspecies of the Genus *Neotoma*. Proc. Biol. Soc. Wash., ix., pp. 117-128. 1894. Contains descriptions of *N. fallax*, from type taken at Gold Hill, and *N. orolestes* from type taken twenty miles west of Saguache.

MERRIAM, C. H. North American Fauna, No. 8. Monographic Revision of the Pocket Gophers, Family *Geomyidæ* (Exclusive of the Species of *Thomomys*). 1895. Gives Colorado references and records of various species.

MERRIAM, C. H. North American Fauna, No. 10. Revision of the Shrews of the American Genera *Blarina* and *Notiosorex*. C. Hart Merriam. The Long-tailed Shrews of the Eastern United States. Gerrit S. Miller, Jr. Synopsis of the American Shrews of the Genus *Sorex*. C. Hart Merriam. 1895. Describes in last named article a new subspecies (*S. tenellus nanus*) from Estes Park, besides Colorado records of several other species.

MERRIAM, C. H. Preliminary Synopsis of the American Bears. Proc. Biol. Soc. Wash., x., pp. 65-83. 1896. Includes Colorado in range of *Ursus horribilis horriæus*.

MERRIAM, C. H. North American Fauna, No. 11. Synopsis of the Weasels of North America. 1896. Figures skull of *Putorius arizonæ* from a Boulder County, Colorado, specimen.

MERRIAM, C. H. *Phenacomys preblei*, a New Vole from the Mountains of Colorado. Proc. Biol. Soc. Wash., xi., p. 45. 1897. Type of species taken on Long's Peak.

MERRIAM, C. H. Revision of the Coyotes or Prairie Wolves, with Descriptions of New Forms. Proc. Biol. Soc. Wash., xi., pp. 19-33. 1897. Gives part of range of *Canis pallidus* (now known as *C. nebrascensis*) as eastern Colorado.

MERRIAM, C. H. Preliminary Revision of the Pumas (*Felis concolor* Group). Proc. Wash. Acad. Sci., iii., pp. 577-600,

1901. Contains remarks on the Roosevelt series of *F. hippestes* from Colorado.
- MERRIAM, C. H. The Prairie Dog of the Great Plains. Year Book of Department of Agriculture for 1901. Account of habits, directions for destruction, etc.
- MERRIAM, C. H. A New Bobcat (*Lynx uinta*) from the Rocky Mountains. Proc. Biol. Soc. Wash., xv., pp. 71-72. 1902. States that in Colorado and Utah the species is restricted to the mountains.
- MERRIAM, C. H. Eight New Mammals from the United States. Proc. Biol. Soc. Wash., xvi., pp. 73-78. 1903. Contains description of *Putorius streator leptus* from type taken at Silverton.
- MERRIAM, C. H. New and Little Known Kangaroo Rats of the Genus *Perodipus*. Proc. Biol. Soc. Wash., xvii., pp. 139-146. 1904. Contains note on *P. montanus* Baird, the type locality of which is Fort Garland.
- MERRIAM, C. H. Two New Chipmunks from Colorado and Arizona. Proc. Biol. Soc. Wash., xviii., pp. 163-166. 1905. Descriptions of *E. hopiensis* from Kean Cañon, Arizona, and *E. operarius* from Gold Hill, Colorado.
- MERRIAM, C. H. Three New Rodents from Colorado. Proc. Biol. Soc. Wash., xxi., pp. 143-144. 1908. Contains descriptions of *Eutamias minimus caryi*, *Neotoma albigula warreni*, and *Thomomys talpoides agrestis*, from types taken in Colorado.
- MILLER, GERRIT S., Jr. Synopsis of the Voles of the Genus *Phenacomys*. Proc. Biol. Soc. Wash., xi., pp. 77-87. 1897. Contains description of *P. preblei* from Colorado.
- MILLER, G. S., Jr. North American Fauna, No. 13. Revision of the North American Bats of the Family Vespertilionidæ, 1897. Gives Colorado records of a number of species.
- MILLER, G. S., Jr. The Families and Genera of Bats. Bulletin No. 57, U. S. Nat. Mus. 1907. Systematic diagnosis of the families and genera.
- NELSON, EDWARD W. Descriptions of New North American Rabbits. Proc. Biol. Soc. Wash., xx., pp. 81-84. 1907. Contains among others the original descriptions of *Sylvilagus f. similis*, and *S. a. warreni*.
- NELSON, E. W. North American Fauna, No. 29. The Rabbits of

- North America. Washington, 1909. The only complete work on North American rabbits; just published, and very useful.
- OSGOOD, WILFRED H. North American Fauna, No. 18. Revision of the Pocket Mice of the Genus *Perognathus*. 1900. Gives Colorado records of various species.
- OSGOOD, W. H. North American Fauna, No. 28. Revision of the American Genus *Peromyscus*. 1909. An excellent piece of work, recently published, and containing many Colorado references and records.
- PALMER, T. S. The Jack Rabbits of the United States, Biological Survey Bulletin No. 8. 1897. Gives descriptions and ranges of the different species of Jack Rabbits, mentioning Colorado several times, also accounts of Jack Rabbit hunts.
- PIKE, ZEBULON M. An Account of Expeditions to the Sources of the Mississippi and through the Western Parts of Louisiana to the Sources of the Arkansaw, Kans, La Platte, and Pierre Jaun Rivers. Performed by Order of the Government of the United States during the Years 1805, 1806, and 1807, etc., etc., by Major Z. M. Pike. Philadelphia, 1810. Comes' edition, in 3 volumes, published by Francis P. Harper, New York, 1895. Pike mentions Buffalo, Deer (*O. macrourus*); Deer, new species (*O. hemionus*), Nov. 26, 1806, Cheyenne Mountain; Hare; and Bighorn; all within the limits of what is now Colorado.
- PREBLE, EDWARD A. North American Fauna, No. 15. Revision of the Jumping Mice of the Genus *Zapus*. 1899. Gives Colorado records of various species.
- PREBLE, E. A. North American Fauna, No. 27. A Biological Investigation of the Athabasca-Mackenzie Region. Washington, 1908. Has many interesting accounts of the habits of species found in Colorado, and of species allied to ours.
- RHOADS, SAMUEL N. Synopsis of the American Martens. Proc. Acad. Nat. Sci. Phila., May, 1902. Describes *Mustela caurina origenes* from type collected at Marvine Mountain, Rio Blanco County, by Ernest Thompson Seton.
- RHOADS, S. N. Contributions to a Revision of the North American Beavers, Otters, and Fishers. Trans. Amer. Philos. Soc., xix., pp. 419-439. 1898. Gives ranges of two forms in such a way as to include Colorado.
- ROOSEVELT, THEODORE. With the Cougar Hounds. Scribner's Magazine, October and November, 1901. Account of his hunt in

Rio Blanco County. Gives measurements and weights of the animals killed.

ROOSEVELT, T. The Deer Family. By Theodore Roosevelt, T. S. Van Dkye, D. G. Elliot, and A. J. Stone. 1902. The part entitled "The Deer and Antelope of North America," by Theodore Roosevelt, has various Colorado references.

ROOSEVELT, T. A Colorado Bear Hunt. Scribner's Magazine, October, 1905. The ex-President's account of his bear hunt in Colorado, in the spring of 1905.

ROOSEVELT, T. Outdoor Pastimes of an American Hunter. 1905. Contains the articles on the cougar and bear hunts, as well as others.

SAY, THOMAS. Account of an Expedition from Pittsburgh to the Rocky Mountains Performed in the Years 1819 and 20 by Order of the Hon. J. C. Calhoun, Secretary of War; under the Command of Major Stephen H. Long. From the notes of Major Long, Mr. T. Say, and other gentlemen of the party. Compiled by Edwin James, botanist and geologist for the expedition. In two vols. With an Atlas. Philadelphia. 1823. (All Colorado matter is contained in the second volume.) Original descriptions of *Callospermophilus lateralis* and *Eutamias quadrivittatus* from the Arkansas River, below Cañon City; *Myotis subulatus* from near La Junta; *Citellus grammurus* from Purgatory Creek, Colo., Lat. $37^{\circ} 32'$, Lon. $103^{\circ} 30'$.

SETON, ERNEST THOMPSON. The American Bison or Buffalo. (*Bos americanus*, Gmelin, 1788). Scribner's Magazine, Oct., 1906.

SETON, E. T. The Prong-horned Antelope. The Prong-buck of America. (*Antilocapra americana*, Ord, 1818.) Scribner's Magazine, July, 1906.

SETON, E. T. The White-tailed (Virginia) Deer and its Kin. (*Odocoileus americanus*, Erxleben, 1777.) Scribner's Magazine, Sept., 1906.

SETON, E. T. The Wapiti and his Antlers. A Study of the Wapiti or Round-horned Elk of America. (*Cervus canadensis*, Erxleben, 1777.) Scribner's Magazine, Jan., 1906.

SETON, E. T. The Snow-shoe Rabbit. Everybody's Magazine, May, 1907.

SETON, E. T. The Habits of Wolves. Including Many Facts

about Animal Marriage. American Magazine, Nov., 1907. All the above articles by Seton contain accounts of the habits, history, and distribution of the species, and some have specific Colorado references.

STONE, WITMER, and W. E. CRAM. American Animals. A Popular Guide to the Mammals of North America North of Mexico, with Intimate Biographies of the More Familiar Species. 1902. Pictures of several Colorado species, habits, etc.

THOMAS, OLDFIELD. Article in Annals and Magazine of Natural History, 6th ser., xi., p. 406, 1893. Gives description of *Perognathus infraluteus* from type taken at Loveland, Colo.

TRUE, FREDERICK W. Diagnoses of New North American Mammals. Proc. U. S. Nat. Mus., xvii., 1894. Describes at page 241 *Sciurus aberti concolor* (now *S. a. ferreus*); type from Loveland, Colo.

WARREN, EDWARD R. Some Interesting Beaver Dams in Colorado. Proc. Wash. Acad. Sci., vi., pp. 429-437, 1905.

WARREN, E. R. The Mammals of Colorado. Colorado College Publication, Gen. Ser. No. 19, Science Ser. No. 46, vol. xi., pp. 225-274. 1906.

WARREN, E. R. Further Notes on the Mammals of Colorado. Colorado College Publication, Gen. Ser. No. 33, Engineering Ser., vol. i., No. 4, pp. 59-90. 1908.

WHITNEY, J. PARKER. Reminiscences of a Sportsman. 1906. Has some interesting references to the game in the early days of Colorado.

WRIGHT, WILLIAM H. The Grizzly Bear. The Narrative of a Hunter-Naturalist. Historical, Scientific, and Adventurous. New York. 1909. An excellent account of the animal, and apparently adhering strictly to facts, without any fancies.

YARROW, H. C., and E. COUES. See Coues and Yarrow.

YOUNG, ROBERT. Notes on the Distribution of Colorado Mammals, with a Description of a New Species of Bat (*Eptesicus pallidus*) from Boulder. Proc. Acad. Nat. Sci., Phila., July, 1908, pp. 403-409. Notes on the distribution of various species with special reference to the life zones.

The Mammals of Colorado

The Mammals of Colorado

CLASS MAMMALIA

MAMMALS may be defined as vertebrated or backboned animals in which the blood is constantly preserved at a fixed temperature, as a rule somewhat higher than that of the surrounding air; the young are nourished with milk provided by the mother from the mammary glands, which are situated somewhere on the lower side of the body; and the skull is provided with two condyles or swellings posteriorly for the attachment of the chain of vertebræ or backbone.

In addition to these characteristics they are (almost invariably) provided with a covering of hair. They have, as a rule, four limbs furnished with flat nails, claws, or hoofs. Their teeth, when present, are usually separable into three categories: incisors, canines, and molars, in which case they are described as Heterodont; though in some cases, as in the porpoises, when all the teeth are constructed on one pattern, they are termed Homodont. Furthermore, the teeth of the adult are usually preceded by another set, the milk teeth. Finally, the cavity containing the heart and lungs is completely separated from that containing the viscera by a transverse muscular partition, known as the diaphragm or midriff.

Mammals are divisible into three subclasses, of which,

however, only the first is represented in the fauna of Colorado. These are:

1. The *Eutheria*, containing by far the greater number of mammals; in these the young are nourished before birth by means of a placenta; they are found all over the world.

2. The *Metatheria*, containing the Marsupials, the young of which are born in a very rudimentary condition in consequence of the absence of a placenta, an organ by which the young are nourished while still unborn. These animals are found in Australia and America; two species of the well known Opossum are found in the eastern and southern portions of the United States, but the animal has not yet been met with in Colorado.

3. The *Prototheria*, containing the egg-laying *Echidna* and *Ornithorhyncus*, confined to the Australian region.

Out of the nine orders into which the *Eutheria* are generally divided only five are represented in Colorado; the *Primates* (Monkeys), *Edentata* (Ant-eaters), and naturally the two marine orders *Cetacea* and *Sirenia* being absent.

The following key to the five Colorado orders is founded on the most obvious and easily recognized but by no means the most fundamental characters, and does not necessarily hold good for other than Colorado animals.

A. Fore limbs not modified for flight.

a. Feet provided with claws or sometimes flat nails.

a'. Incisor teeth not chisel-shaped, or if so, more than two in number above and below.

a''. Upper lip projecting beyond the lower; middle pair of incisors larger than the others. **Insectivora.**

b''. Upper lip not projecting; middle pair of incisors not larger than the others. **Carnivora.**

b'. Incisors chisel-shaped; in the upper usually, and in the lower jaw invariably two in number only. **Rodentia.**

b. Feet provided with solid hoofs in which the last joint of the toe bone is embedded. **Ungulata.**

B. Fore limbs modified for flight; fingers elongated to support a membranous wing. **Chiroptera.**

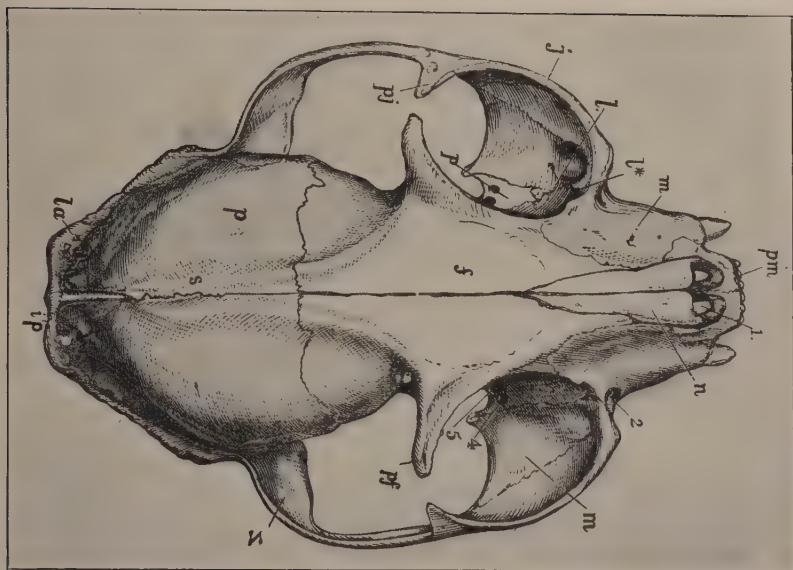


FIG. 2. DORSAL VIEW OF SKULL OF HOUSE CAT—AFTER MIVART.

f, Frontal.
j, Malar.
l, Lachrymal.
*l**, Lachrymal foramen.
la, Lambdoidal ridge.
m, Maxillary.
n, Nasal.
p, Palatine.
pf, Postorbital process of frontal.

pf, Postorbital process of malar.
pm, Premaxilla.
s, Sagittal suture.
x, Posterior pier of zygomatic arch.
I, Incisive foramen.
2, Infra-orbital foramen.
4, Posterior palatine foramen.
5, Spheno-palatine foramen.

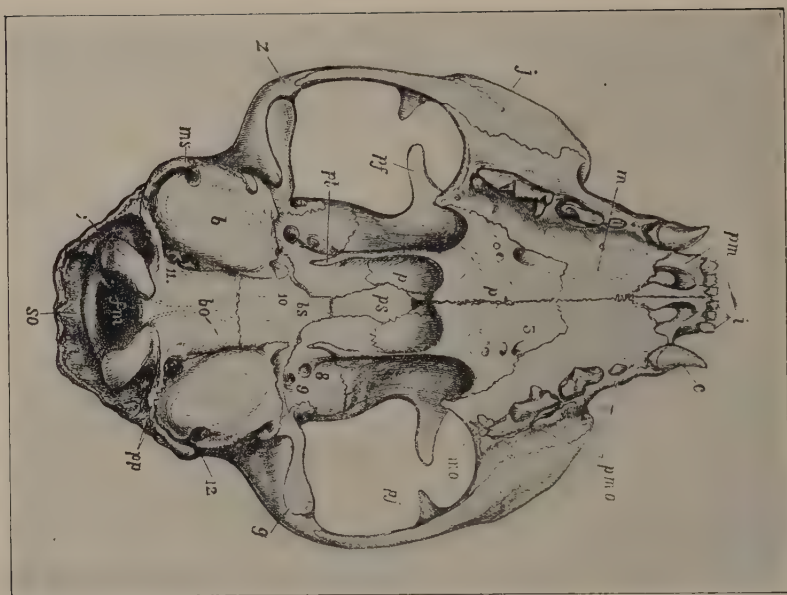


FIG. 3. UNDER SURFACE OF SKULL OF HOUSE CAT—AFTER MIVART.

The Two Openings Enclosed by the Pre-Maxillæ and Maxillæ are the Anterior Palatine Foramina.

- | | |
|---|---|
| <i>b</i> , Auditory bulla. | <i>pf</i> , Postorbital process of frontal. |
| <i>bo</i> , Basi-occipital. | <i>pj</i> , Postorbital process of malar. |
| <i>bs</i> , Basi-sphenoid. | <i>pm</i> , Premaxilla. |
| <i>c</i> , Canine. | <i>pmo</i> , Premolars. |
| <i>fm</i> , Foramen magnum. | <i>pp</i> , Paroccipital process. |
| <i>g</i> , Glenoid surface. | <i>ps</i> , Presphenoid. |
| <i>i</i> , Incisors. | <i>pt</i> , Pterygoid process. |
| <i>j</i> , Malar. | <i>so</i> , Supra-occipital. |
| <i>m</i> , Maxilla. | <i>Z</i> , Posterior root of zygoma. |
| <i>mo</i> , Molar. | <i>3</i> , Palatine foramen. |
| <i>ms</i> , Mastoid process. | <i>8</i> , Sphenoidal fissure and foramen rotundum. |
| <i>oc</i> , Occipital condyle. | <i>9</i> , Foramen ovale. |
| <i>pp</i> , Palatine (placed one above, the other beneath, the opening of the posterior nares). | <i>10</i> , Eustachian opening. |
| | <i>11</i> , Foramen lacerum posterius. |

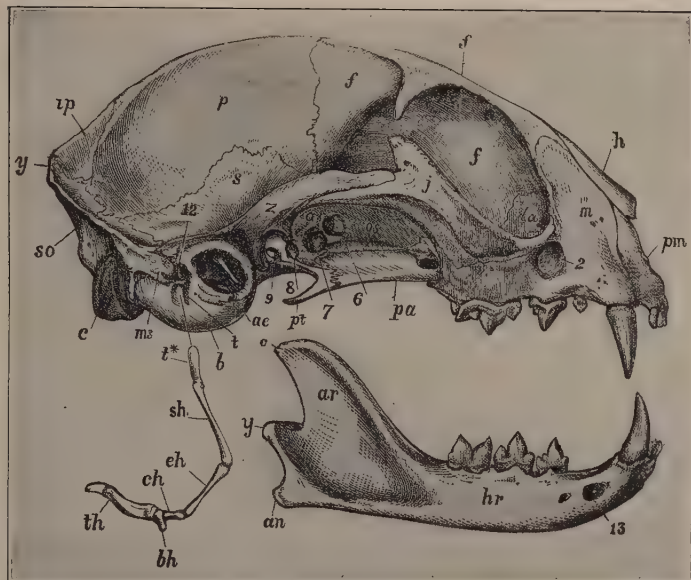


FIG. 4. SIDE VIEW OF CAT SKULL, WITH THE LOWER JAW AND THE HYOIDEAN ARCH SOMEWHAT DETACHED—AFTER MIVART.

a (just above 6 and 7), Ali-sphenoid.
ae, Meatus auditorius externus.
am, Angle of mandible.
ar, Ascending ramus.
b, Auditory bulla.
bh, Basi-hyal.
c (of cranium), Occipital condyle.
c (of mandible), Coronoid process.
ch, Cerato-hyal.
eh, Epi-hyal.
f, Frontal.
hr, Horizontal ramus of mandible.
ip, Interparietal.
j, Malar (or jugal).
la, Lachrymal.
m, Maxilla (its nasal process).
ms, Mastoid process.
n, Nasal.
os, Orbito-sphenoid.
p, Parietal.

pa, Palatine.
pm, Premaxilla.
pt, Pterygoid.
s, Squamosal.
sh, Stylo-hyal.
so, Supra-occipital.
*t**, Cartilage of tympano-hyal.
th, Pit of tympano-hyal.
y, Apex of lambdoidal ridge.
z, Infra-orbital foramen.
o, Optic.
7, Sphenoidal fissure.
8, Foramen rotundum.
9, Foramen ovale.
12, Stylo-mastoid foramen.
13, Mental foramina.

The sphenopalatine foramen is shown just above, and in front of, *pa*, close to posterior margin of anterior end of zygoma.

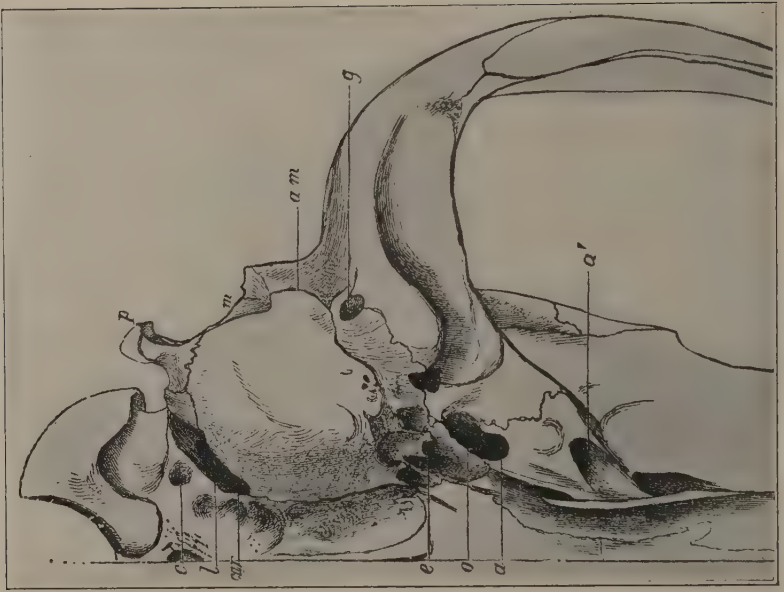


FIG. 5. PORTION OF SKULL OF WOLF—AFTER FLOWER.

The right half of the base of the cranium of the wolf (*Canis lupus*) to show:—*c*, condyloid foramen; *l*, foramen lacerum posterius; *car*, carotid canal; *e*, Eustachian canal; *o*, foramen ovale; *a*, the posterior, and *a'*, the anterior, opening of the alisphenoid canal; *p*, the paroccipital process; *m*, the mastoid process; *am*, the external auditory meatus; *g*, the glenoid foramen, below which is the glenoid cavity for the condyle of the mandible (after Flower).

ORDER UNGULATA

In this order are comprised all those animals which may be roughly described as hoofed animals, such as pigs, deer, sheep, oxen, horses, and elephants. Although some of these differ very markedly from one another, not only in outward appearance but also in internal structure, the study of the large number of allied fossil forms tends to bring them together. At the same time it is difficult to construct a diagnosis which will include them all.

The following, however, brings out their most important characteristics: Ungulates are terrestrial and mainly vegetable-feeding mammals, with limbs adapted to progression and not to prehension, with from five to only one digit, the terminal phalanges of which are usually enclosed in a solid horny hoof, though in some cases there are broad, blunt nails; clavicles absent; humerus with no entepicondylar foramen; scaphoid and lunar bones always distinct; a full set of milk teeth not completely replaced until adolescence; molars broad with ridged or tuberculated crowns.

This order, containing the largest of all living terrestrial animals, is not well represented in the fauna of the State of Colorado. Out of twelve recent families generally recognized only three are represented and these are all included in the suborder *Artiodactyla*, characterized by the predominance of the third and fourth digits of the fore and hind limbs, which with their hoofs form a symmetrical pair, while the second and fifth are smaller and of no practical importance, or are wanting altogether.

The following key shows the most conspicuous characters by which the families and genera may be distinguished.

- A. Frontal appendages in the form of true horns, *i. e.*, a bony process of the skull ensheathed by a hollow horny covering.

- a. Horns never branched, and retained through life. (Bovidæ.)
 - a'. Horns smooth and rounded. Bison, p. 4
 - b'. Horns transversely wrinkled and rough. Ovis, p. 9
- b. Horns branched and shed periodically. (Antilocapridæ.)
Antilocapra, p. 13
- B. Frontal appendages in the form of antlers, formed of true bone, and covered during growth with a vascular hairy skin; these are shed annually. (Cervidæ.)
 - a. Smaller; antlers without basal tines, only a single short, upwardly directed basal snag; tail long.
Odocoileus, p. 18
 - b. Larger; antlers with two basal tines forwardly directed; tail short. Cervus, p. 24

Family BOVIDÆ

Frontal appendages, when present, consisting of a long bony process attached to the frontal bone, termed the horn-core; this is ensheathed with the true horn, which is therefore hollow, and consists of an epidermic development of hard fibrous matter; these horns are not shed periodically, but remain in situ and increase in size during the whole life of the animal; dentition, i. $\frac{0}{3}$; c. $\frac{0}{1}$; pm. $\frac{3}{3}$; m. $\frac{3}{3} \times 2 = 32$; upper incisors and canines absent; lower canines resembling the incisors, and following them without a gap; molars usually hypsodont (*i. e.*, with long crowns); lateral (*i. e.*, 2d and 5th) digits usually completely absent, or represented by the small "false" hoofs; gall-bladder always present.

Genus BISON. (The ancient Teutonic and Scandinavian name of the European form.)

Bison, H. Smith in Griff., *Anim. Kingd.*, v., p. 373 (1827). Type, *B. bison* Linnæus.

This genus contains that section of the Wild Oxen distinguished by their rounded horns, their transversely arched foreheads, their prominent orbits, and the great development of hairy mane on the fore part of the body. Two species only are generally recognized, the European Bison (*B. bonasus*), now only existing in the primeval forests of

Lithuania, Roumania, and the Caucasus, where it is artificially preserved, and the American Bison, which also now survives only in a semiferall condition, with the exception of the bands of so-called Wood Bison ranging about the Great Slave Lake in British America, and numbering altogether perhaps five hundred head.

Bison bison. The American Bison or Buffalo.

Bos bison Linn., *Syst. Nat.*, 10th ed., i., p. 72 (1758).

Type locality.—Mountains of the Southeastern United States.

Literature on History and Habits. Allen, "History of the North American Bison," *Ann. Rep., U. S. Geol. Sur. Terr.*, 1875, pp. 443-587 (1877). Hornaday, "Extirpation of the American Bison," *Rep. U. S. Nat. Mus.*, 1887, pp. 369-548 (1889). Thompson Seton, "The American Bison or Buffalo," *Scribner's Magazine*, xl., p. 385 (1906).

Measurements.—Height at shoulders of full grown male, 5 ft. 8 ins., of female, 4 ft. 8 ins.; weight of male, 1800 lbs., of female, 800 lbs.

Description.—Head, neck, chest, and shoulders blackish brown, sometimes black without any brown; remainder of coat paler, grading on rump to cinnamon. Muzzle, hoofs, and horns black.

Distribution.—The range of the Bison originally extended almost to the Atlantic Coast from Pennsylvania to Georgia, and to the western slopes of the Rocky Mountains, and from the Mackenzie River region, in North Lat. 62° south into northern Mexico. To-day, with the exception of the above mentioned herds in the Far North there is probably not a single wild example left anywhere. They are undoubtedly all gone in Colorado, the last survivors having been those in the Lost Park region in Park County.

Habits.—The Buffalo were always found in herds of greater or less size, but until their extermination on the plains their numbers were very great, and the herds correspondingly large, composed of thousands of individuals. Not much information has been left about the habits of the animal east of the Mississippi, in which region they had been exterminated by the beginning of the last century. On the western plains they wandered in herds which seem to have been in a sense merely parts of one great body. They

were more or less migratory, moving north in the spring two hundred to four hundred miles, and south again in the fall. When the Union Pacific Railroad was built across the plains in 1867-1870, it seemingly split the herds into two parts, which became known as the northern and the southern herds. This separation was probably caused by the great amount of hunting along the railroad. In 1874 the southern herd was practically exterminated, though a few individuals and small



FIG. 6. BUFFALO BULL

Photographed in the Goodnight Herd, Texas, by Donald DeWitt

bands lingered until 1889. The last one in southeastern Colorado was killed near Springfield, Baca County, in 1889.

The northern herd lingered longer, but was gone in 1885. A few scattered ones remained, as in the case of the southern herd, but every man's hand was against them, and they have followed their friends. The last bull in the Pike's Peak

region was killed in 1879, but a few cows remained for about ten years longer.

Hornaday estimates that in 1870, just after the completion of the Union Pacific Railroad, there were about four million buffaloes south of the Platte River, and probably about one million and a half north of it. His estimate of the number killed in the southern herd in the years 1872, '73, and '74 is 3,698,730. Of this vast number 3,158,730 were killed by



FIG. 7. BUFFALO

Photographed in the Goodnight Herd, Texas, by Donald DeWitt

the professional white hide and meat hunters, about 85 per cent. Less than half of these were utilized, the others were wasted, wandered away wounded, and died, etc. The Atchison, Topeka & Santa Fé Railroad carried in those years 459,453 hides, other roads about twice as many more. At that time the hide of a full grown buffalo was sold by the hunter for \$1.25; when the northern herd was extermi-

nated in the early eighties hides sold for \$1.50 to \$3.50. What they were worth seventy-five years ago is shown by the following letter from John Jacob Astor to the writer's grandfather, who was at that time a fur dealer in Boston:

OFFICE AM. FUR COM'Y,
June 25, 1834.

DEAR SIR

By accounts rec'd I believe the quantity of Buffalo Robes will not be large, the price at St. Louis is 4\$. We sell them here by quantity at $4\frac{1}{4}$, I hope you will not sell for less—

If you want muskrat skins I will thank you to give us an opportunity to supply you—as also Beaver

Respectfully yours,

JOHN JACOB ASTOR,
for Am. Fur Co.

MR. M. BATES,
Boston.

This letter has been copied verbatim, spelling and all, a little punctuation being supplied—Mr. Astor seems to have been too busy to bother with that.

According to Catlin, in his *North American Indians*, the American Fur Company's traders were at that time paying the Indians a pint of whiskey for each robe. I believe the company made its own whiskey from alcohol and water—mostly water.

The calves were born in spring, usually about April, but the season seems to have varied from January to August. Within three or four days after birth the calf was able to travel, and after that it and its mother lived with the herd.

In Colorado, and the other mountain States also, buffalo were found in the mountains as well as on the plains; by the hunters these were considered as different from the plains

animal, and were spoken of as the Mountain Buffalo. The principal difference, real or supposed, seems to have been a darker color and possibly a finer coat. They ranged high, above timber-line at times. I have found a skull in Gunnison County at 11,000 feet. One man told me that the mountain animal was a bison, and the plains animal a buffalo! Rather a peculiar distinction.

The Wood Buffalo of the North has been separated as a subspecies *B. bison athabascæ*.

Genus OVIS (Lat., A sheep)

Ovis Linnæus, *Syst. Nat.*, 10th ed., i., p. 70 (1758). Type, *O. aries* Linnæus.

This genus containing the Wild Sheep is spread over the mountainous ranges of Asia and Western America, while one species, the Moufflon, inhabits Corsica and Sardinia.

In addition to the well-known Bighorn of the Rocky Mountain chain, which is still to be found in Colorado, a number of other species of American Wild Sheep, some of them of very doubtful validity, have been described during recent years.

Ovis canadensis (from or belonging to Canada). Mountain Sheep, Bighorn.

Ovis canadensis. Shaw, *Nat. Miscell.*, xv., p. 610 (1804).

Ovis cervina Desmarest, *N. Dict. Hist. Nat.*, p. 5 (1804).

Type locality.—Eastern slope of Rocky Mountains between Missouri and Saskatchewan rivers.

Measurements.—Total length, about 60; tail vert., 3-5; height at shoulders, 40; length of horns around curve, 40-50, the record is 52.50, from the Selkirk Mountains, B.C. (*Recreation*, vii., p. 11, 1897). Hornaday gives two of 17½ and 17¼ for circumference around base, each of which measured 18½ when fresh; this is of course unusually large, but the horns were not extraordinarily long, being 34½ and 32 respectively; their widest outside spread was 21 and 23¾, with distance between tips 17¾ and 16. Of course all

these measurements vary greatly with individuals, and the largest and most massive horns come from the northern portion of the animal's range; those from the southern limit in northern Mexico, while of good size at the base, are slender compared with northern specimens.

Description.—Grayish brown above, with dark line along centre of back; face ashy gray, neck grayish brown tinged with plumbeous; under parts, buttocks, inside of legs, on each side of base of tail and upper part of throat whitish; legs dark grayish brown; tail above like the back.

Distribution.—The Mountain Sheep is found along the higher mountain ranges from British Columbia and Alberta in about North Lat. 55° southwards to Sonoyta and Pinacate, Sonora, Mexico, about 30 miles south of our boundary, on the northeast shore of the Gulf of California, for Hornaday considers the sheep of that region to be this species, having come down the Colorado River from Colorado and Utah and through Arizona. In Alaska and the Mackenzie and Yukon territories of Canada it is replaced by Stone's, Dall's, and Fannin's Sheep, and in California and Lower California by Nelson's Sheep and an allied form, and in the mountains of Chihuahua, Mexico, and of western Texas and eastern New Mexico by the Mexican Sheep.

In Colorado the Mountain Sheep is still to be found in most of our mountain counties, though its numbers are not what they were once, but with a close season all the year as has been the case for several years, they are gradually increasing in number, in spite of a certain amount of poaching which goes on.

Habits.—As its name would lead one to infer, the Mountain Sheep is an inhabitant of the mountains, living in the higher altitudes, near and above timber-line in the summer, and moving somewhat lower in winter. The roughest sort of ground seems to be their choice, and they travel without hesitation over places which make a man think twice before following. They are somewhat gregarious, occurring in flocks of varying size. In the spring and summer these are composed of the ewes with their lambs, which are born in the early summer, with yearlings and young rams, while the older rams keep by themselves alone or in smaller bands. In the fall, when the rut begins, the rams seek their mates, and fights often occur between rivals for the possession of

the females. They are polygamous, and each ram gathers as large a harem as he can protect from his rivals. These mixed flocks keep together a good deal during the winter, dividing in the spring when the time comes for the birth of the young. Where not hunted, they are, like most animals, not particularly suspicious, and living as they do in the high, less frequented spots, they have possibly retained this trait longer than some other species, and it has worked to their disadvantage. As a consequence they have come quite near extermination in Colorado, though, as stated above, they are now on the increase, thanks to the long close season they have had, lasting over several years. Their food is largely grass and the plants growing at higher elevations, and they may also browse on twigs to a certain extent, especially in winter.

We occasionally hear reports of a strange animal in Colorado, and some of the other mountain States, which the informant usually calls an "ibex"; this is nothing more than the female Mountain Sheep, whose horns, instead of curving around to the front beside the head, are nearly straight, curving but little, and projecting backward rather than forward.

We used to read in the old books that the Mountain Sheep had no hesitation about jumping from the most precipitous places, and that it turned in mid air so as to light on the horns, thus saving itself from the shock and most likely from broken limbs; this story was long ago exploded; in fact if the sheep did turn in the air it would strike on its nose instead of its horns, and the result would be unpleasant, if not disastrous. But just how a sheep did strike the ground was still a disputed point, but an observation made by Judge D. C. Beaman, of Denver, shows how it is done in some, if not all cases. He with some others was hunting bear with dogs, on Sapinero Creek, Gunnison County, and a Mountain Sheep was followed by the dogs and brought to

bay at the edge of a cliff 20 or 25 feet high; when too closely pressed by the dogs he jumped off the cliff. Mr. Beaman describes it as follows: "He made a sidewise spring straight out from the edge of the precipice, apparently six or eight feet, and then spread his feet in a sort of bracing way, and with his body in a perfectly horizontal position, and parallel to the face of the cliff dropped straight down to the foot of the cliff. . . . The position of this sheep when dropping was stiff legged, but the instant his feet touched the ground his joints gave way, with increasing resistance, however, his joints acting as springs, until his belly almost touched the ground, before the force of the impact was overcome by the muscular resistance." (*Outdoor Life*, xx., p. 253, 1907.) This observation was made at a distance of about 300 yards, and while probably correct in the main points, possibly some of the details may have not been caught as closely as one could wish, but this is no disparagement of an observation which is, so far as we know, unique.

In that same region, at the head of Sapinero Creek, a considerable number of Mountain Sheep died of scab contracted from domestic sheep which had been herded there. One party told me that the remains of 75 head or more were found lying within a short distance of each other. It is possible that occurrences of this sort may have been an important factor in the decrease of the wild sheep at times. It is not quite so likely to occur nowadays, for the sheepmen are much more particular about protecting their flocks against this disease, and but few sheep are now allowed to be pastured on the Forest Reserves in Colorado, none in most of them, and most of our Mountain Sheep are on the reserves.

Family ANTILOCAPRIDÆ

Frontal appendages resembling those of the *Bovidae* in most respects, consisting of unbranched horn-cores, and true

epidermal horns which, however, are branched and shed annually, and are replaced by fresh ones formed on the horn-core underneath the old horns. In other respects closely resembling the *Bovidæ*.

Genus ANTILOCAPRA. (Lat. *antilope*, antelope, and *capra*, goat.)

Antilocapra Ord, *Journ. de Phys.*, vol. 87, p. 149 (1818). Type, *A. americana*.

Revision, Lyon, *Proc. U. S. Nat. Mus.*, xxxiv., pp. 393-402 (1908).

Horns compressed at base; flattened process in front; lateral hoofs absent; hair stiff, coarse, brittle; tail very short; horns in the female rudimentary or absent. Dentition, i. $\frac{0}{4}$; c. $\frac{0}{6}$; p. $\frac{3}{3}$; m. $\frac{3}{3} \times 2 = 32$.

This genus, the only one of the family, contains but a single species, the American Antelope or Pronghorn, though Merriam has recently separated the southern form from Northern Mexico and Lower California as a distinct subspecies.

Antilocapra americana (*americana*, American).

American Antelope or Pronghorn.

Antilocapra americana Ord, in *Guth. Geog.*, 2d Amer. ed., ii., p. 292 (1815).

Measurements.—Total length, 50; tail vert., 7; height at shoulders, 36; weight about 100 lbs. This is for the male, females being somewhat smaller. The horns are 12 ins. or less in length. The record is $17\frac{1}{4}$ and $17\frac{3}{8}$ for the left and right horns respectively, measured around the curve (E. S. Dodge, Arizona).

Description.—Upper parts and sides yellowish brown; band between eyes covering forehead, nose, and a spot below ear liver-brown; sides of head, spot behind ear, throat, front of neck extending in two triangles into the brown on either side, entire under parts and rump white; legs yellowish brown; hoofs, horns, and naked skin on nose black (Elliot). The animal has a large number of cutaneous glands, as follows: 1 postmandibular, 1 ischial, 2 interdigital, 1 hock, present as pairs, and a median gland on the lower back, above the white patch of the rump.

Distribution.—The Pronghorn was formerly found throughout the plains country and the valleys and parks of the Rocky Moun-

tains from the valley of the Saskatchewan in North Lat. 53° southwards into Mexico to about Lat. 22° , and from the valley of the Missouri in about Lon. 95° west to the Pacific. Nowadays, while its range in latitude is much the same, its east and west range is greatly restricted, only about half what it was once, and is especially irregular to the west. This distribution of course includes both forms of the animal; the range of the typical form extends about to the Mexican boundary.

In Colorado it was formerly found all over the plains region east of the foothills; in all the large mountain parks, and in such other localities as might be suited to it.

Now it has largely been exterminated, but is still to be found in small numbers in most of our plains counties, and there are also a few in North, Middle, and South Parks, in the San Luis Valley, and possibly in a few other isolated localities in the State. The close season which has been enforced on the animals for several years past has been beneficial, and their numbers have somewhat increased.

Habits.—The Antelope was first seen by European eyes by the celebrated Spanish explorer Coronado in 1535, who speaks of their occurrence in what are now the plains of Kansas as “*siervos, remendos de blanco*” (the stags patched with white). It is chiefly an inhabitant of the dry open plains, living on the grass, sage, and other herbaceous plants which grow in those regions. Where there is water antelope drink once a day, but in some of the country frequented by them water is absent, and in its place the animal eats the large juicy cacti found in such regions, and whose sap quenches its thirst.

The young, which are one or two in number, are born in late May or early June; they are kept hidden by the mother for a few days, but are soon able to run well, and then follow her about, and she often joins others and they go in small mixed bands. The rutting season begins sometime in September and continues through October. They are polygamous, and each buck gathers as large a harem as he can, often having to fight other males for the possession of his wives. In winter the Pronghorn gathers in bands of all

ages and sexes, which sometimes perform a sort of migration to some region more favorable for winter quarters. In the old days some of these winter herds were immense. Major J. B. Pond wrote Thompson Seton: "In the winter of 1868-69, I travelled on the new railroad for the first time from Denver to Cheyenne. The Antelope had all left the open plains, and



FIG. 8. PRONGHORN. *Antilocapra americana*

Photographed in the City Park, Denver, Colo., by E. R. Warren

were now sheltering among the foothills. For ten or twelve miles in Cache la Poudre Valley, and all the way west of the train, about three quarters to one half a mile away, was one long band of Antelope, twenty to forty rods wide, practically continuous and huddled together for warmth. Their numbers changed the color of the country. That winter many wagon-loads were brought to Denver and sold, three or four carcasses for two bits (25 c.) that being the smallest coin in use."

Seton figures that if there is no error in the figures it meant at least two million Antelope. Dr. Coues, in his list of the Maxwell collection, says: "I have nowhere else found Antelope so abundant as they were in the North Park in the summer of 1876. They were almost continually in view, and thousands must breed in that locality."

The curious white area on the buttocks is covered with long hairs which can be raised at the will of the animal and spread rapidly; when this is done in bright sunlight the buttocks shine almost like tin pans and can be seen at a great distance; the apparatus probably serves both as a recognition mark and as a danger signal.

The speed of the animal is very great, probably exceeding that of any other North American game animal; Seton estimates its best speed at 32 miles an hour, but such a rate cannot be kept up for any distance, and then the animal's curiosity is also apt to get the better of its judgment, and it stops to look around and see what alarmed it. This curiosity used to be taken advantage of by hunters, who enticed the animals within range by waving a handkerchief or making some actions to attract their attention and get them to approach closer.

The local range of individuals and bands is usually not very great, and they keep closely in one neighborhood, excepting when they perform the migrations above described.

The shedding of the horns is rather a curious process, probably unlike that of any other mammal. Lyon describes the process as follows: "The kids are born during the spring and are of course at that time hornless. By the middle of summer the first horns begin to appear, being small and conical and concealed in the hair of the forehead. They reach a length of nearly an inch by autumn. Early in the winter they drop off, leaving small knobs projecting from the frontal region about half an inch long and covered with hairs.

Inside of a week these knobs are again covered with a small cap of horn. This horn increases in size from the base, for a year, attaining a length of nearly six inches. The characteristic prong is not present at this age. In the early winter these horns drop off, leaving horn-cores about an inch and a half in length, covered, as in the first year, with a hairy

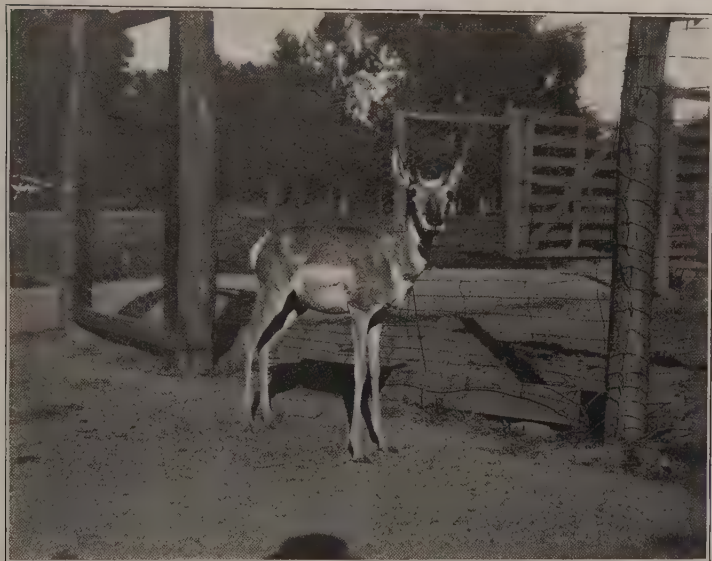


FIG. 9. PRONGHORN. *Antilocapra americana*
City Park, Denver, Colo., Rob't B. Rockwell, Photographer

skin. Horns immediately form on their tips, and in addition, at the base and in front of the horn-core another point of horn forms, which becomes the prong. By a gradual conversion of the skin covering the horn-core into horn, the horny tip at the apex of the core and the horny tip of the prong are consolidated into one solid horn. This process is repeated annually, the successive horns gradually becoming larger, until the maximum size is reached, which takes about

five years. The fully matured horn has a strongly recurved and somewhat incurved tip and bears a well-developed prong in front. . . . The mechanical factor in the dropping off of the horns appears to be the rapid development of a new horn on top of the horn-core and beneath the old horn which is about to be shed. This newly growing horn pushes the old one upward, loosening it from the horn-core to which it has been attached by the continuity of its substance with that of the horny layer of the skin covering the core. . . . In the autumn of the year the horns of the Antelope are always loosely attached to the bony core, and can be pulled off with but little effort." The horns are shed in autumn or early winter, and old bucks drop their horns earlier than younger animals do.

Family CERVIDÆ

Frontal appendages, when present, in the form of antlers; these are outgrowths of true bone, and are covered during growth with a vascular sensitive skin, the velvet, which peels off when growth is completed; antlers shed annually, or at any rate periodically, and in most cases branched; dentition: i. $\frac{0}{3}$; c. $\frac{0 \text{ or } 1}{1}$; pm. $\frac{3}{3}$; m. $\frac{3}{3}$; anterior molar of both jaws brachyodont (*i. e.*, short crowned); upper canines usually present in both sexes; the lateral digits of both fore and hind limbs almost always present; gall bladder absent.

KEY OF THE GENERA

- A. Size larger, total length 100 or more; antlers with brow and bez tines, Cervus, p. 24
- B. Size smaller, total length 72 or less; no brow or bez tines on antlers, Odocoileus, p. 18

Genus ODOCOILEUS (Gr. *odous*, tooth + *koilos*, hollow)

Odocoileus Rafinesque, *Atlantic Jour.*, i., p. 109 (1832). Type, *O. americanus*.

This genus contains a group of the Deer family charac-

terized by the absence from the antlers of the brow and bez tines which project forward over the forehead; their place is taken by a sub-basal upwardly directed snag, usually present, but of small size; antlers in the male only; tail long and thickly haired beneath; face glands small; upper canines absent; skull with the vomer dividing the posterior nares into two distinct chambers; lateral metacarpals complete.

The deer forming this group are found throughout the greater part of North and South America. They are subject to very considerable local variations, with a general tendency to become smaller and to bear somewhat simpler and lighter antlers as we go southwards. As a result a very large number of new species have been described of late years. Elliot in his recent revision of North American Mammals recognizes 15 species and 13 subspecies in America north of the Isthmus. These divide themselves naturally into two groups, represented by the Virginian or White-tailed Deer, and the Columbian and Californian Black-tailed Deer and the Mule Deer. In Colorado the genus is represented by a western form of the Virginian Deer, and by the typical form of the Mule Deer; they can be distinguished as follows:

- A. Ears moderate, about half the length of the head; tail brown above, white below; antlers with a large sub-basal snag; beam forwardly directed, the anterior branch the largest and longest; glands on the metatarsus, short, about one inch in length. **O. macrourus**, p. 19
- B. Ears large, $\frac{2}{3}$ to $\frac{3}{4}$ the length of the head; tail white-tipped, with a black tuft; antlers with a short sub-basal snag; beam upwardly and outwardly directed, forking dichotonously, both branches approximately equal; glands on the metatarsus long, about five inches, **O. hemionus**, p. 22

Odocoileus americanus macrourus (Gr. *makros*, long, + *oura*, tail). Western White-tailed Deer.

Cervus macrourus Rafinesque, *Amer. Monih. Mag.*, i., p. 436 (1817).

Type locality.—Plains of the Kansas River, Kansas.

Measurements.—Total length, 90; tail vert., 12. We have no measurements at hand of antlers of this form. Seton notes one from the Adirondacks having antlers 32 ins. long, and with a spread of 26½ ins. This was the eastern, or rather the northern subspecies. The record for points is one killed in Texas, having 78 points.

Description.—*Summer pelage:* Upper parts and outside of limbs reddish brown.

Autumn pelage: Yellowish gray mixed with black; chin and throat white, dusky spot on chin; under part of neck brownish gray; legs pale brownish yellow; under parts white; tail, above reddish brown, beneath white.

Distribution.—This form of the White-tailed Deer was formerly found throughout the plains of Kansas, Nebraska, and the Dakotas, and westward into the eastern portion of the Rocky Mountains, but apparently not reaching the Pacific slope of the Continental Divide, and ranges from near Edmonton, Alberta, southward into northern New Mexico. Through much of this territory it has been exterminated. It should be stated that according to Seton its range has recently been extended into Utah, "irrigation making more country possible for the species."

In some portions of Colorado it was at one time common, but is now very rare. The only instances of its occurrence at the present time which I have been able to hear of are near Watervale, and in the Fisher's Peak region, Las Animas County, and on Cottonwood Creek, near Cotopaxi, Fremont County.

Habits.—The White-tailed Deer is an inhabitant of the forests, woods, and swampy places rather than of the open or mountainous country. In the West it has been found more in the brushy bottoms along the streams, and this probably accounts for its whole or partial extermination in Colorado, at least, for these bottoms are usually the first places to be taken up by the settler, and especially was this the case on the plains before the days of irrigating ditches. The result is that the deer either leave or are killed off. The fact that these deer are very local in their habits, keeping within, or "using," as the hunters say, in a small area is also a factor in this matter. The White-tail does not migrate from higher to lower ground with the approach of winter as the Mule Deer does but is an all-the-year-round resident.

The fawns are born in May or June, usually only one though some times two are born. The weight at birth is about four pounds. The rut, as in the other deer, is in the autumn, and fierce battles are often waged between the rival bucks. But they are not polygamous, a buck usually having but a single mate, though they have been known to have two or more. The antlers are shed early in the winter, the new growth begins immediately, the full size is attained by the middle of August, and the velvet is rubbed off and the horns are polished up ready for battle by the middle of the succeeding month. Many pairs of interlocked horns have been found at various times and places, attached to the skulls, and occasionally the dead bodies also, of deer which had thus become entangled and been unable to separate themselves, and perished of starvation.

In the East and South the White-tailed Deer was at one time exceedingly abundant, and found in great numbers. Then in many localities it was practically exterminated, but with the protection afforded by stringent laws is once more regaining its numbers.

Some twelve or more forms of the White-tailed Deer have been described by naturalists. These vary much in size, the northern forms being much the largest, specimens of these having been known to attain a weight of 350 pounds, while those from Florida and some parts of Mexico are much smaller, full grown bucks weighing 100 pounds or less.

The sight of all our American deer seems to be poor, though their sense of smell is excellent, and it is on that which they depend largely as a means of detecting the presence of an enemy. Certain it is that a deer will stand and look at a motionless person who is out in plain sight without taking any alarm until a movement is made, when away it will go. This has been my own experience, and that of many others with whom I have talked, and most

of the books on the habits of the animals bear witness to the same fact. On the contrary an antelope has excellent sight, and can recognize an enemy at a long distance, and its eyes stand out so prominently from the side of its head that it probably has a wide field of vision.

Odocoileus hemionus (Gr. *hemionos*, mule). Mule Deer. Black-tailed Deer.

Cervus hemionus Rafinesque, *Amer. Monthly Mag.*, i., p. 436 (1817).

Type locality.—Sioux River, probably on eastern border of South Dakota.

Measurements.—Total length 68; tail vert., 6; height at withers, 42; length of antlers around outer curve from 16 up. A specimen in the Colorado Museum of Natural History at Denver, killed in Rio Blanco County in 1908, had an extreme spread of 39 ins.; the right antler measured $27\frac{1}{4}$ and the left $28\frac{3}{8}$ ins., around the outer curve; the antlers measured $5\frac{7}{8}$ ins. in circumference at base; there were 13 points on the right and 12 on the left. This is a very unusual set of horns, even if not the record, the spread especially being very wide. A pair of horns found by J. W. Frey and myself hanging on a corral fence near Douglas Spring, Routt County, has a total of 34 points.

Description.—In summer pale dull yellowish or yellowish tawny; this is replaced in the autumn by a bluish gray coat, growing lighter in color as the hairs lengthen in winter. A dark brown patch on forehead between the eyes and extending below them on the face; remainder of face and throat white, as are also the abdomen, inner side of legs and buttocks; rest of underparts blackish brown; tail white; tip black; ear bordered with black anteriorly.

Distribution.—Beginning at about W. Lon. 102° in the Dakotas, Kansas, Nebraska, and Oklahoma, the Mule Deer has a range to the west into the eastern portions of British Columbia, Washington, Oregon, and California; there is also an eastwardly extending tongue along our northern border in Minnesota and Manitoba to about Lon. 95° . It also ranges from Lat. 57° in Alberta south into northern New Mexico. This is for the typical form; there are subspecies which carry the range much farther south into Mexico and Lower California.

In Colorado it is found in probably every county from the east base of the foothills west to the Utah line. We have no records of its occurrence in any of the plains counties at present.

Habits.—While this deer has just as good a right to the name “Black-tail” as the Californian and Pacific Coast animal, yet it seems best to avoid confusion and to call it the Mule Deer, a name which has never been applied to the other. This species is rather fond of the rough country, the mountains and foothills rather than the valleys and river bottoms, though it is likely at times to be found on any kind of ground within its range. In summer it moves up to considerable elevations, the does stopping somewhat lower down than the bucks, more among the aspens and other deciduous growth, while the bucks often get up into the green spruce and pine timber. There is, however, much variation in these habits and he who tries to lay down a hard and fast rule for all the deer will surely get himself into trouble. In autumn and early winter the deer move lower down; in western Colorado, in Rio Blanco and Routt counties, this is a regular migration, the animals coming from the higher mountainous parts of those counties where most of them spend the summer and drifting gradually to the lower altitudes where there is little or no snow, gathering in herds, which twenty-five years ago and less numbered thousands of individuals. Even to-day, in the thinly settled sections of those counties, the number in these winter gatherings is often great. In other parts of western Colorado this migration also occurs, but is perhaps not quite as noticeable, owing to the smaller number of deer.

This species feeds much on the leaves of various bushes and other plants, and perhaps not as much on grass as some other deer.

The breeding habits are much the same as in other species, the fawns being born in May or June, and the rut being in the fall, late September and October. The bucks chase the does continually and sometimes have several in their harems. Hornaday says this species nearly always has two young at a birth.

The enemies of the deer, besides man, are the mountain lion or cougar, the gray wolf, bobcats pick up a fawn occasionally, and it is likely the coyotes do the same.

This deer is a silent animal, a snort of alarm or the bleat of the doe being about the only noises it makes. Its gait is very peculiar, entirely unlike that of the White-tail, Elk, Antelope, or Mountain Sheep; it "consists of a series of stiff-legged bounds, all four feet leaving and striking the ground at the same time" (Roosevelt). This is the usual gait, but it also trots and occasionally gallops.

Genus CERVUS (Latin, Stag or Deer)

Cervus Linn., *Syst. Nat.*, i., p. 166 (1758). Type, *C. elaphus* Linnæus.

Revision, Lydekker, *Deer of all Lands* (1898).

This genus contains those deer, allied to the Red Deer of Europe, whose antlers are characterized by possessing two basal tines springing close together from the main stem, and projecting forwards over the forehead.

Antlers are only present in the male; the canine teeth are well developed in the American species; vomer never ossified and dividing the osseous posterior nares into two passages; only the proximal portion of the lateral metacarpals persisting.

The members of this genus are spread all over the northern part of the Old and New Worlds. In addition to the well known species described here, two others, *C. merriami* Nelson, from the mountains of Arizona and New Mexico, and *C. nannoides* Merriam, from Kern County, California, have recently been described, while the Pacific Coast Wapiti from British Columbia and the coast ranges of Washington and Oregon is regarded as a subspecies (*C. canadensis occidentalis* H. Smith) of the wide-spread form.

Cervus canadensis. (From or belonging to Canada.)
American Elk or Wapiti

Cervus elaphus canadensis Erxl., *Syst. Regn.*, i., p. 305 (1777).

Type locality.—Eastern Canada.

Measurements.—These are variable, the males being larger than the females, besides varying much among themselves. Total length about 110; tail vert., 8 or 9; height at withers from 50 to 68 (this last being a record); weight 600 lbs. or more, there being no very satisfactory data on this point, a full grown bull probably weighing at least 700 pounds; length of antlers along outside curve 55 to 60, a record being 66.5 and 64.5 for the right and left beams respectively—this was killed in Gallatin County, Montana; circumference between brow and bez tines 8.

Description.—A detailed description hardly seems necessary, as the size and general appearance of the elk at once distinguish it from all other species. The head, neck, and under parts are dark brown, sometimes black or nearly so beneath; sides, back, and thighs yellowish gray; a white or straw colored patch on rump uniting with white between the hind legs, the lower border of this being black; legs brown. The color varies in individuals.

Distribution.—The Elk was formerly spread over the greater part of the United States and Canada from western Pennsylvania, the Adirondacks in New York State, and eastern Canada (about Montreal), to eastern Oregon and Washington, and from nearly 60° North Latitude in Alberta in the North south to Lat. 35°, this last limit being, according to the map on Thompson Seton's article in *Scribner's Magazine*, very irregular, varying from 32° to 38°. It has now been exterminated over most of this great extent of territory, and only survives in a wild state in the Rocky Mountain region from about Lat. 55° in Alberta into Colorado, its centre of abundance being in the Yellowstone National Park and in the Jackson Hole in Wyoming, where in winter enormous herds may still be seen.

In Colorado the Elk was formerly abundant in the mountainous part of the State, and was also found in much of the plains portion, but it is now nearly exterminated, there being but a very few left; these are scattered in various localities in Larimer, Grand, Routt, Rio Blanco, Gunnison, Garfield, Delta, Mesa, Mineral, and the adjoining counties.

Habits.—The Elk or Wapiti is of social and polygamous habits, which fact has no doubt been one of the factors which led to its destruction. The males are commonly known as bulls, and the females as cows, while the fawns are called calves, and I will use these terms in my account of the habits of the animal. When they were comparatively

unmolested their habits through the year were much as follows: after spending the winter at the lower altitudes where the snow was not too deep, in the spring the herds began to move toward the higher elevations, the cows stopping somewhat lower down than the bulls, in the aspen growth, where in late May and early June the young were born, while the bulls went higher up, into the heavier green spruce and pine timber, where it was cooler and shadier, and where the growth of the antlers was completed. This took place in August, and in the next month they began to move about seeking the cows, and uttering their love call or challenge, "bugling" as it is commonly called. The bulls now gathered their harems, and often fought viciously with each other for their possession. After the rut was over and the snow began to fall the herds gradually drifted down to their winter ranges, where there was little or no snow, and here they remained, subsisting on grass, and browsing on the brush and twigs, until the time came around once more for them to return to their summer homes. Nowadays this is much changed, at least in Colorado. Here the animals have been so much persecuted, and in many places the country has become so well settled that the elk no longer dare to come to the lower altitudes which they formerly frequented, but remain higher up, where the snows are deeper, and food harder to obtain. Consequently they are not in as good condition in the spring, and it is not at all unlikely that some may starve to death during the winter. In the Jackson Hole, Wyoming, where the largest bands now winter, a serious condition has arisen because of the settling up and fencing of the winter range of the elk. The animals still come to the region in great numbers for the winter, but finding their range much fenced in, are often in serious straits for food, and break down and jump over the ranchmen's fences and attack their haystacks. The State of Wyoming has done

a certain amount of feeding during hard winters, and in the Yellowstone Park the United States authorities have done the same. In the spring of 1909 the State Game Warden of Colorado fed some in Gunnison County.

The young are one or two, and occasionally three in number and have a spotted coat the first few months of their lives, until September, when it is shed for one resembling that of their parents, who at the same time don their winter suits. The new-born calves are kept concealed by the mothers for a few days, until they are able to follow, but for some time the youngsters spend much of their lives hidden away from prying eyes.

The bulls shed their antlers in March or April, and the new horn at once begins to grow, and attains its full size in late July or early August, when the velvet dries up and peels off, being assisted by rubbing the horns against trees and branches. It is not until the velvet has entirely disappeared and the horn become thoroughly hardened that the rut commences, and the bugling is heard. This has been described as "a tremendous guttural roaring that rises in pitch to trumpet tones and higher until it breaks into a shrill screaming whistle, then fades and drops again into the guttural, followed and ended by a few savage grunts" (Seton). The bugling is frequently followed by terrific fights which have been known to result in the death of both parties owing to the interlocking of the antlers in one of the furious charges made.

A series of antlers dropped in successive years by an elk in captivity was kept by the Duke of Bedford. After the first pair of spike horns, the succeeding antlers never had less than five points on each side until the ninth year, when there was only a single horn on each side, which apparently curved forward at first and then turned upwards. The pair which succeeded these had many points, but was quite

irregular, and soon after the animal was killed. During the sixth, seventh, and eighth years the antlers had six and seven points on a side. Antlers with as high as twenty-eight points altogether have been known.

According to Seton, the name Elk for this animal first occurs in the narrative of Capt. George Waymouth's *Voyage to Virginia* in 1605. It is of course more properly applied to the European form of the Moose (*Alces machlis*), and a more correct name for the animal is undoubtedly "Wapiti," first recorded by Dr. B. S. Barton (*Medical and Physical Journal* of Philadelphia for March, 1806, p. 37). This is the name by which it was formerly known among the Shawnee Indians, and if it could be universally adopted would be by far the best appellation.

ORDER RODENTIA

This order, containing the gnawing animals, such as the squirrels, rats, and rabbits, is very well defined, being readily characterized by the chisel-like incisors of both the upper and lower jaws and by the absence of canines.

Other distinguishing features are as follows: Feet plantigrade or semi-plantigrade, generally provided with five clawed toes; incisors growing continually during life from persistent pulp, those of the upper jaw either four or two, those of the lower jaw never more than two; premolars reduced, usually only one above and below, arranged in an unbroken series with the molars, which may be rooted or rootless; the molars always separated from the incisors by a definite space; skull with the orbit communicating freely with the temporal fossa and with the condyle of the mandible elongated antero-posteriorly so as to allow of a backward and forward and also a small lateral movement of the lower jaw; clavicles generally present; cerebral hemispheres smooth and not overlapping the cerebellum; intestines

usually with a large cæcum; testes inguinal or abdominal; uterus two-horned; placenta discoidal and deciduate.

The rodents are mostly small animals of herbivorous habits adapted to terrestrial, arboreal, subterranean, or occasionally to natatorial life; the order contains a much greater number of species than any other; rodents are cosmopolitan, being found all over the world, though perhaps more abundantly represented in South America at the present day than elsewhere.

The following key is only put together to distinguish Colorado families and genera.

KEY OF THE COLORADO SUBORDERS AND FAMILIES

- A. With four incisors in the upper jaw, the second pair small and placed directly behind the front pair. (**Duplicidentata.**)
 - a. A short bushy tail; ears long and narrow. **Leporidæ.**
 - b. No external tail; ears short and rounded. **Ochotonidæ.**
- B. With only two incisors in the upper jaw. (**Simplicidentata.**)
 - a. Body partially at any rate covered with stout, stiff, sharp spines which are modified hairs. **Erethizontidæ.**
 - b. Hairs covering the body never modified into stout, stiff spines.
 - a'. Hind limbs more or less kangaroo-like, and adapted for jumping.
 - a''. Without external, but with small internal cheek pouches; toes five in number, metatarsals separate. **Zapodidæ.**
 - b''. With external cheek pouches; toes five in number. **Heteromyidæ.**
 - b'. Fore and hind limbs subequal; the hind limbs never kangaroo-like.
 - a''. With well developed external cheek pouches opening on either side of the head. Limbs stout and adapted for digging. **Geomyidæ.**
 - b''. No external cheek pouches.
 - a '''. Tail round and scantily haired, or naked and scaly; skull without postorbital processes. **Muridæ.**
 - b '''. Tail broad, flattened horizontally, naked and scaly; skull with postorbital processes. **Castoridæ.**
 - c '''. Tail round, more or less hairy or bushy, without scales; skull with distinct postorbital processes. **Sciuridæ.**

SUBORDER DUPLICIDENTATA

With two pairs of incisors in the upper jaw; the second pair small and placed directly behind the larger pair; the enamel of the incisors extending right round, and not confined to the front surface; incisive foramina of the palate large and usually confluent; fibula ankylosed with the tibia, and articulating with the calcaneum.

Family LEPORIDÆ

Animals of moderate size, with long ears, elongated hind limbs, and short, recurved tails; skull somewhat compressed, with characteristic wing-shaped postorbital processes; facial aspect of the maxillaries perforated and reticulated; teeth more numerous than in any other family of rodents; incisors large, and upper ones grooved; premolars $\frac{3}{2}$; molars rootless with transverse enamel folds.

A large family found throughout the world except in the Australian region; a recent reviser, Lyon, has divided it into ten genera, and five subgenera, of which five genera and five subgenera are North American; but Nelson, in his just published monograph, only recognizes four genera and two subgenera in North America.

KEY OF THE GENERA

- A. Interparietal not distinct in adult; size of Colorado species, with one exception, large; hind foot about 6; some species change color in winter. Lepus, p. 30
- B. Interparietal persistent in adult; size of Colorado species all small; hind foot about 4; never change color in winter. Sylvilagus, p. 44

Genus LEPUS (Lat., meaning a hare)

Lepus Linnæus, *Syst. Nat.*, ed. 10, i., p. 57 (1758). Type, *Lepus timidus* Linn.

Revision, Lyon, *Smithsonian Miscell. Coll.*, xlv., pp. 321-447 (1904). Nelson, *North American Fauna*, No. 29 (1909).

Skull high, superior outline much curved, especially at occipital region; supraorbital usually more or less broadly wing-like and subtriangular in outline, the posterior process in the majority of species long, more or less divergent, flanking a deep, wide notch, the posterior extremity sometimes completely fused with skull, sometimes not; interparietal not persistent in adult; all the openings of the skull are large; orbits very large, meeting in the mesial line of the cranium; dentition, i. $\frac{3}{1}$; p. $\frac{3}{2}$; m. $\frac{3}{2} \times 2 = 28$; incisors deeply implanted in the jaws, molars rootless; third upper molar minute; last lower molar large, but still much the smallest of the lower series; front feet with five toes, hind feet with four; hind legs elongated, in some species greatly so.

Members of the genus are found all over North America from the Arctic regions southward through Mexico as far as the State of Chiapas. Many species and subspecies have been described, Nelson's recent paper recognizing 43 species and subspecies, of which five have been reported from Colorado.

KEY OF THE SPECIES

- A. Size small, length about 17; hind foot comparatively long, 5.75; ear short, 2.75; turns white in winter.

L. bairdi, p. 38

- B. Size large, length 22-24; ears long, 4.25-5.75.

- a. Profile of skull high and arched; rostrum short and deep; tail white on upper surface, or with but little black; winter pelage lighter in color than the summer, often white.

- a'. Head and body above yellowish gray; black patch on tip of ears broader. *L. campestris*, p. 32

- b'. Head and body above dull grayish; black patch on tips of ears narrower. *L. campestris townsendi*, p. 37

- b. Profile of skull low and flattened; rostrum long and comparatively shallow; upper surface of tail with large black area; winter pelage about the same as the summer.

(Subgenus *Macrotolagus*.)

- a'. Upper parts, including ears, rich ochraceous buffy gray; rump patch strongly marked; ears shorter, about 4.25.

L. californicus melanotis, p. 41

- b'. Upper parts gray with a slightly buffy tinge; gray rump patch fairly well marked; ears longer, 4.75-5.25.

L. californicus texianus, p. 43

Lepus campestris (Lat., of the fields). White-tailed Jack Rabbit.

Lepus campestris Bachman, *Journ. Acad. Nat. Sci. Phila.*, viii., p. 349 (1837).

Type locality.—Plains of the Saskatchewan, Canada, probably from near Carlton House.

Measurements.—Total length, 22; tail vert. 3.25; hind foot, 5.75; ear, 5.75.

Description.—Summer pelage: Yellowish buffy gray above, varying in brightness, usually darkened by brownish color of under fur showing through; sides of head somewhat paler or grayer than

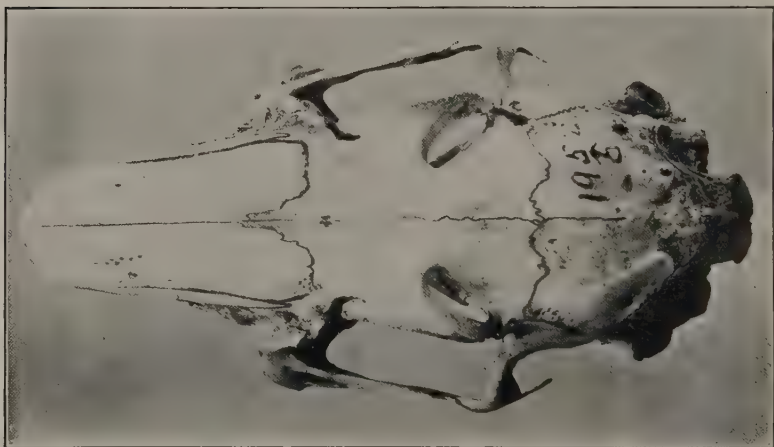


FIG. 10. *Lepus campestris*, WHITE-TAILED JACK RABBIT
Dorsal view of skull, about natural size

back; sides of nose and ring around eye white; nape pale dull buffy; rump similar to rest of back, a little paler on sides; tail usually entirely white, but sometimes with black or dusky hairs on middle of upper side, forming a narrow median line; this is present in every specimen I have seen from the San Luis Valley; front and outside of fore legs and tops of fore feet dingy buffy, varying somewhat from grayish to ochraceous; outside of hind legs a little duller than back; rump in midsummer similar to back, but pale in early spring and late fall; underside of neck dull buffy, sometimes grayish tinged, sometimes ochraceous; rest of underparts white; anterior half

of outside of ears dusky brownish; border edged with ochraceous buffy; posterior half of outside of ear white, with a broad terminal black patch extending to include border of ear at tip.

In winter pelage this species varies greatly, depending upon locality, or perhaps it would be more exact to say upon climate. Where there is snow on the ground all winter, the animal is practically white, the rump being entirely so, while the longest hairs of the back are white, but underneath these are dark hairs which show when the hair is lifted up; the nape is white, and the pectoral band becomes very pale; the black tip of the ear is always persistent. In those localities where the ground is bare all or nearly all winter, the upper parts become paler than in summer, the color varying from a quite clear gray to a pale pinkish buff, and this variation is not confined to any particular locality, for the two colors may be found in specimens from the same place; the rump is almost always white; the buff on the legs is also paler than in summer.

The upper outline of the skull is quite highly arched, and the rostrum is short, broad, and deep. The posterior process of the supraorbital is wide, flaring outward and upward, and not approaching closely to the frontal, nor attached to it by a cartilage.

Distribution.—This species is found east of the Rocky Mountains, south from the plains of the Saskatchewan in Alberta, Saskatchewan, and Manitoba, through Montana, most of Wyoming, the Dakotas, Minnesota, Iowa east to the Mississippi, Nebraska, north half of Kansas, and in Colorado.

In Colorado, east of the foothills, it is found south nearly to the Arkansas River; west of the foothills, and east of the Continental Divide, it occurs south to the New Mexico line, and is found along the middle-northern border of New Mexico. East of the mountains the White-tailed Jack Rabbit is relatively more abundant than the Black-tailed in the northern half of the region, while the reverse is the case for the southern portion.

Habits.—All the Jack Rabbits have from two to six young in a litter, four being probably the average number, but whether more than one litter is born in a season I cannot say, at least for our Colorado species. But the young are probably born in May or June, and possibly in late April, this depending no doubt somewhat on locality. The young of all these rabbits are born fully furred and with their eyes opened.

All the species of Jack Rabbits are lovers of the open

country, living on the plains, or in such cases as when they live in the mountains they are found in the open parks and not in the timber, as in the case of the Snow-shoe Rabbit, or else they are found inhabiting the high Alpine slopes and meadows above timber-line. The White-tailed Jacks are the only ones which are found in these high altitudes; we have no record of the Black-tails reaching an altitude of over 8,000 feet.

Usually Jack Rabbits do not live in burrows, but make forms under bushes or clumps of weeds. In some localities the sagebrush (*Artemisia*) affords shelter, and in others the shrubby "rabbit brush" (*Chrysothamnus* and its allies) is their haunt, as it often grows in great abundance on the plains and makes excellent cover. While more or less of diurnal habits, yet the Jack Rabbit is most likely to be about in the early morning and the late afternoon, or just at dusk. Thanks to their size, when full grown they have not very many enemies, as coyotes, wolves, and eagles are about the only animals which can catch and kill them then, though of course bobcats and mountain lions may pick them up occasionally when the opportunity offers, but these latter animals do not hunt much in such ground as the Jack Rabbits frequent. The larger hawks and owls, as well as weasels, kill the young rabbits, very possibly in considerable numbers, and snakes most likely capture a small one now and again.

All rabbits are vegetarians, not eating flesh, except in those instances where domesticated rabbits have been known to devour their own young. This vegetable food consists of grass and other herbaceous plants, and the leaves, buds, bark, and fruit of woody plants or trees. The green soft plants are of course preferred, but under stress of hunger almost any part of the plant the animal can get at is eaten. Thus in winter, when there are deep snows, the bark of valuable orchard and

shade trees is often gnawed and the trees seriously injured. Gardens are frequently much harmed by rabbits, as they are very fond of the growing vegetables; alfalfa and clover fields are frequently much damaged by rabbits.

Because of the rapidity with which rabbits increase in numbers the damage done by them has been at times a very serious matter and various measures have been taken to destroy the animals. In some States bounties have been paid for Jack Rabbits. In others hunts and drives on a large scale have been organized, and the animals killed in large numbers, which seem almost incredible. In Colorado, about the middle of the nineties, several hunts took place at and near Lamar, Prowers County. After the first one or two of these which were gotten up and participated in by local residents only, larger hunts were organized, to which people came from the outside in considerable numbers, and for which excursion rates were made by the railroad. One, which took place December 22 and 23, 1894, was especially successful, 101 gunners taking part, and 5,142 rabbits being killed as the result of a day and a half of steady work. Altogether, in Prowers and Las Animas counties, in the years 1893, '94, and '95, over 32,000 rabbits were killed in these organized hunts, to say nothing of those which must have been killed by individual hunters and parties. After the first year the greater number of the rabbits thus killed were distributed, under the direction of the Rev. Thomas Uzzel, among the poor of Denver and Pueblo. These hunts no longer take place, and the rabbits are not as abundant as formerly, though of course still common. About all the rabbits killed in these hunts were Jack Rabbits, and probably by far the greater number were Black-tails, *L. melanotis*, this being by far the most common rabbit in that region.

But it is in the San Joaquin Valley, California, that the greatest number of rabbits have been killed by organized

efforts. Here the animals were destroyed by driving them into an enclosure, and they were then killed with clubs by men on foot. The rabbits were driven to the place by a large number of men, both on foot and on horseback, who began operations away from the entrance and gradually worked toward it, driving the rabbits ahead of them until they were forced into the enclosure. This was of wire netting, and usually with wings extending for a considerable distance on either side; at one drive these wings covered a space of seven miles. In 207 drives from 1888 to 1897 inclusive, 494,634 rabbits were killed. These figures are from the Biological Survey Bulletin on the Jack Rabbits. Drives and hunts have also been held in other States besides those mentioned, but it is hardly necessary to describe them particularly.

Like the Snow-shoe Rabbit, Jack Rabbits are subject to epidemics, which at times destroy large numbers of them. We do not find much information as to their nature, Preble being the only one who gives us any report about it, at least of late. He examined a number of Varying Hares (*Lepus americanus*) in the upper Mackenzie region which had died of the disease, and found the throat and lungs much inflamed, the viscera were in an excessively moist condition, and the skin and flesh were very dry, and separated with difficulty. These epidemics occur every five to seven years. They have been known in Colorado, but do not affect the whole State at the same time apparently, being seemingly local in their effects. There was one in the San Luis Valley two or three years ago; and in Grand and Routt counties, in the spring and summer of 1907, it was reported to me that the rabbits had been killed off by some disease; certainly they were very scarce all through that season, when I was collecting there, and especially anxious to get good series of the rabbits; Cottontails were fairly plentiful, but Jacks were but seldom seen.

Lepus campestris townsendi (for J. K. Townsend, the naturalist and traveller). Western White-Tailed Jack Rabbit.

Lepus townsendi Bachman, *Jour. Acad. Nat. Sci. Phila.*, p. 90 (1839).

Type locality.—Old Fort Walla Walla, Washington.

Measurements.—Total length, 24.0; tail vert., 4.0; hind foot, 6.25; ear, 5.75.

Description.—Top of head and back dull grayish, the depth of the color being rather variable, some specimens being paler and somewhat grayer than others; other markings as in *campestris*, from which it is distinguished by gray instead of buffy color of the upper parts. The winter pelage is paler on shoulders, sides of body, and rump, and paler buffy gray on top of head and neck; nape grayish white; this coat is as variable as in the case of *campestris*, and, as in the case of that species, is entirely white in the colder portions of its range. Some specimens from western Montrose County show an excessive amount of black in their tails, and are then very difficult to distinguish by external characters from the true Black-tails. The cranial characters are essentially the same as in *L. campestris*, excepting that the posterior end of the postorbital process, instead of being always free from the frontal, is often joined to it by a cartilage as in the case of the Black-tailed Jack Rabbits. The skull always has, however, the high-arched outline of *campestris*.

Distribution.—The Western White-tailed Jack Rabbit is found from Fairview, Okanagan Valley, British Columbia, south through eastern Washington and Oregon, into extreme northwest California, western and southern Idaho, northern Nevada, extreme southwest Wyoming, most of Utah, and Colorado west of the Continental Divide, there meeting the west boundary of the range of *campestris*. It has been recorded from Grand, Routt, Eagle, Summit, Gunnison, Delta, and Montrose Counties, all of these being from my own notes. The species has a vertical range from 1,000 feet in eastern Washington to 12,000 feet in Colorado, where I have taken specimens at timber-line near Boreas Pass, Summit County. Its zonal range is mostly in Upper Sonoran and Transition, but also reaching the Hudsonian and even Alpine.

Habits.—We have more data at our command as to the breeding habits of this form than of *campestris* proper. Two females taken at Sulphur Springs, Grand County, altitude 7,665 feet, April 13, 1907, each contained four small em-

bryos; one killed at Bailey's Ranch, Eagle County, altitude 6,500 feet, May 25, 1907, contained three young which would have been born that day. One taken near Yampa, Routt County, 7,700 feet, May 28, 1907, was nursing. August 5, 1907, two females were killed on Baldy Mountain, near Boreas Pass, Summit County, at an elevation of 12,000 feet; one of these contained four young about ready for birth, and the other five which would have been born in a week or less. The lateness of the date suggests that they may have been second litters. It seems as if the young born at such a late date at this altitude would hardly be large enough to take care of themselves before winter would set in, which it does very early at such elevations, beginning with the first storms in early October, and even late September; after this the nights are cold, and the snow which falls persists on the northerly slopes, and soon all the mountains are covered. Yet the rabbits winter in these regions, very probably keeping about those spots where the high winds sweep all or almost all the snow away. The thick scrubby spruces just at timber-line afford excellent shelter against the weather. Mr. H. L. Curtiss tells me that he has seen them at 12,000 feet on Fairview Mountain, near Pitkin, Gunnison County, in midwinter, and that they kept about these wind-swept places. In the summer we found them just at the very edge of timber-line, at the last trees, where there were smooth grassy slopes.

These rabbits will, sometimes at least, use burrows, for one was seen near Yampa to enter a hole, and was captured in a trap set at the entrance.

In weight these rabbits vary from six to nine pounds, specimens having been weighed at various seasons.

Lepus bairdi. Rocky Mountain Snowshoe Rabbit

Lepus bairdi Hayden, *Amer. Nat.*, iii., p. 115 (1869).

Type locality.—Near Fremont Peak, Wind River Mountains, Wyoming.

Measurements.—Total length, 17; tail vert., 1.75; hind foot, 5.75; ear from notch (dried skin), 2.75–3.0.

Description.—*Summer pelage*: Above brown with a certain amount of blackish showing, this being due to the fact that while the hairs are brown or fulvous tipped, an inner portion is blackish, and this sometimes shows; the bases of the hairs are fulvous; this refers to the outer coat of long hairs; under this is another of dense woolly hair, fulvous in color; tail above like back, below white; top of head a reddish brown, rather ruddy, ears black-tipped, white-bordered, otherwise brownish; underparts white, with a pectoral band similar in color to the back, but somewhat paler; hind feet white, with soles pale fulvous; fore feet brownish.

Winter pelage: White all over externally, except black tips of ears; the long outer hairs are entirely white; those of the short inner coat are white on the surface, pale fulvous at base.

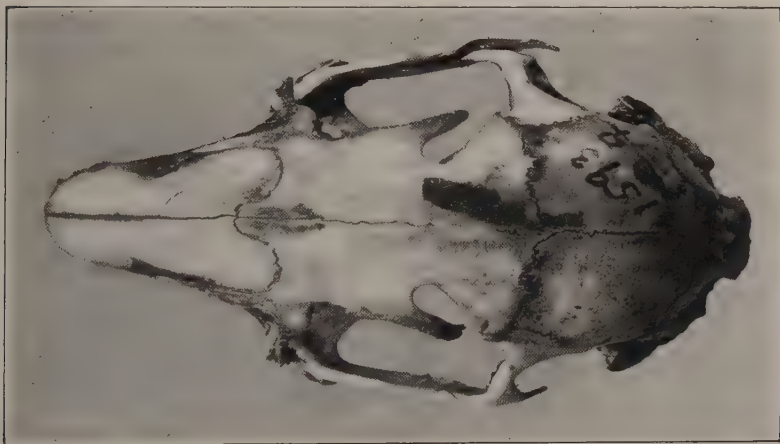


FIG. II. ROCKY MOUNTAIN SNOWSHOE RABBIT, *Lepus bairdi*
Dorsal view of skull x $1\frac{1}{2}$

In spring and fall all intermediate stages between these two coats may be found. Dr. J. A. Allen has written a very interesting paper on these changes, based on the examination of a large series of specimens. The method of the change is as follows: In the autumn the change begins with the ears, head, and feet, which become white due to the shedding of the dark colored hairs, and their replacement by white ones; this change gradually extends over the back and remainder of the body, the long dark hairs being replaced

by entirely white ones, while the new coat of under fur is white-tipped, with pale fulvous base. In the spring, the change is the reverse, beginning with the back and head, while the feet are usually the parts to be last affected. This change is rather irregular in individuals, and at the same time specimens may be taken in quite different stages of the moult. Three specimens in my collection, taken at Sulphur Springs, Grand County, illustrate this very nicely. One, taken April 21st, has a dark patch on the rump, and others showing elsewhere; another, killed on the 23d, is grayish and brown all over the back and top of head; while a third, taken on the 24th, has just a little of the dark coat beginning to show through the white one. These animals were all killed in the same patch of spruce timber, and the snow was from two to three feet deep there at the time. Specimens taken at that locality April 1st are in practically the full winter pelage.

The skull is rather long and slender, with slender postorbital processes, the posterior portions of which are widely separated from the skull, and not attached thereto; nasals and rostrum narrow.

Distribution.—Higher parts of the Rocky Mountains from New Mexico north through western Wyoming and eastern Utah into Montana and Idaho at least to the north boundary of the United States; its exact northern limit is not known to me. It is also found in eastern Oregon and Washington. In Colorado it is found in the mountains from 7,500 feet up to near timber-line, almost always in brushy or timbered districts, but has been known as low as 6,500 feet in Gunnison County, in winter. It is not known to me to occur in the Pike's Peak Range.

Habits.—The Snowshoe Rabbit is found in the forests in the high mountains, not only in the more open woods composed of large timber, but also in the thick second growth of small trees which spring up to replace those destroyed by fire, or which have been cut down for lumber; it also frequents the thickets of willows along the streams in the high mountain parks. This rabbit does not live in burrows, but makes a form under a bush or tuft of grass, and it is in nests made in such situations that the young are born. These may be from two to six in number, and are born some time in the late spring or early summer, but we have no exact evidence bearing on our Colorado animals.

The animal is very local in its habits, not wandering very far from its form, and if startled therefrom and pursued, will almost invariably circle about and return to it within a short distance.

The disproportionately large hind feet, with their widely spreading toes, form admirable snowshoes, and enable the animal to make its way about in comparative ease in the deep snows of the regions where it lives. Except in very soft snow the rabbit sinks in but little. The track left by the hind foot is much larger than that of a jack rabbit having a hind foot of equal length.

The group of rabbits which are known under this name are subject to a periodical epidemic which destroys large numbers of them. In the northern portions of British America, where the Indians and trappers are largely dependent on these rabbits for their winter's food, this epidemic is a very serious matter at times, and by killing so many of the rabbits reduces the natives to very serious straits. This epidemic occurs every six or eight years, when the animals are in their greatest abundance; their numbers become reduced, in a year or two, to nearly nothing; then they gradually increase again until they are as common as ever; then another epidemic, and so it goes in cycles. I have no account of any such disease among our Colorado Snowshoe Rabbits, though, as noted previously, something similar occurs among the jack rabbits.

Lepus californicus melanotis (of or from California;
Grk. *melas*, black + *otis*, ear). Great Plains
Jack Rabbit.

Lepus melanotis Mearns, *Bull. Am. Mus. Nat. Hist.*, ii., p. 297 (1890).

Type locality.—Near Independence, Montgomery County, Kansas.

Measurements.—Total length, 23.5; tail vert., 3.0; hind foot, 5.5; ear, 4.25.

Description.—Upper parts, including ears, rich ochraceous buffy gray, often with a pinkish tinge, and with a certain amount of wavy



FIG. 12. GREAT PLAINS JACK RABBIT, *Lepus c. melanotis*
Dorsal view of skull, natural size

black markings; this is caused by the fact that some of the hairs have buff tips, while others, the smaller portion, have black tips; the



FIG. 13. GREAT PLAINS JACK RABBIT, *Lepus c. melanotis*
Skull, showing dentition, natural size

inner portion of the buff-tipped hairs is blackish; there is also a dense woolly inner coat, nearly white in color; strongly marked grayish rump patch. Along the middle of the rump, from about the end of the buff color, is a black marking extending to the tail, and the upper side of the tail is also black, with just a white edge showing about it, from the hairs of the under side. Posterior portion of ears whitish, with about an inch of black tip; anterior portion of ear mixed black and brown, with buff edge, lined inside with buff hairs; pinkish buff pectoral band; buff on feet as in *campestris*; rest of underparts white. Individuals vary somewhat in the depth of the color. There is no essential difference between the winter and summer coats, and as a matter of fact the Black-tailed Jack Rabbits have but one annual moult, which takes place in late summer and early fall.

The profile of the skull is low and flattened; rostrum long and comparatively shallow; posterior portion of postorbital process flaring outward and upward, but the upward flare is not as great as in *campestris*, and the process is somewhat narrower than in that species; the end of this process approaches closely to the frontal, and is attached to it by a cartilage, leaving a rather wide oval foramen.

Distribution.—The Great Plains Jack Rabbit is found from northwestern Texas and northeastern New Mexico northward through Oklahoma, Kansas, Nebraska, and eastern Colorado, touching southeast Wyoming and extreme southwest South Dakota, and has also been taken in southwestern Missouri. In Colorado it is found east of the mountains, from the north to the south boundaries of the State, and increasing in abundance as we go south. We have no records of the species from west of the foothills or from the San Luis Valley. It has a vertical range from less than 1,000 feet in Kansas to a little over 6,000 feet at the base of the mountains in Colorado. Its zonal range is mainly Upper Sonoran.

Habits.—As with the White-tailed Jack Rabbits the young are born in spring and summer. The only exact data I have for Colorado is a female taken April 6, 1905, at Lamar, which contained three small fetuses which would not have been born until about the first of May.

Lepus californicus texianus (of or from Texas). Texas Jack Rabbit.

Lepus texianus Waterhouse, *Nat. Hist. Mamm.*, ii., p. 136 (1848).

Type locality.—Unknown, probably from western Texas.

Measurements.—Total length, 23.5; tail vert., 3.5; hind foot, 5.5; ear, 4.75–5.25.

Description.—Upper parts gray with a slightly buffy tinge, usually darkened by a thin wash of black, sides of head and body grayer; a fairly well marked gray rump patch; ears decidedly longer than in *L. melanotis*, as is shown by the measurements given. One or two specimens from Coventry, Montrose County, taken in winter, are quite pale, but others, taken at the same place and season, are the usual color. There are no cranial differences to be noted between this form and *melanotis*, except somewhat larger bullæ.

Distribution.—The Texas Jack Rabbit is found north from northern Durango, Mexico, through Chihuahua, arid western Texas (except northern Panhandle), New Mexico (except northeastern part), northeastern Arizona, and southwest Colorado. Its vertical range is from 1,500 to 7,500 feet, and the zonal range mostly Upper Sonoran, but extending up into the Transition, and down into Lower Sonoran.

The Colorado records are Bayfield and Fort Lewis, La Plata County; Ashbaugh's Ranch, Montezuma County; Norwood, San Miguel County; and Coventry, Montrose County.

Genus SYLVILAGUS (Lat. *sylva*, a wood, + Grk. *lagos*, a hare, = wood-hare or rabbit).

Sylvilagus Gray, *Ann. Mag. Nat. Hist.*, 3d. Ser., xx., p. 221 (1867). Type *S. nannus* = *sylvaticus* = *floridanus mallurus*.

Revision, Lyon, *Smithsonian Miscell. Coll.*, xlv., pp. 321–447 (1904). Nelson, *North American Fauna*, No. 29 (1909).

General characters and appearance similar to *Lepus*. Interparietal persistent as a distinct bone in adult; skull and teeth lighter than *Lepus*; rostral portion wider than high; postorbital processes united with the cranium behind (in old individuals), inclosing a narrow foramen; upper surface of skull much less pitted than in *Lepus*; skull much arched above, sometimes wider than one half its length; head relatively larger than in preceding genus; hind legs relatively shorter as referred to Colorado species; pelage never turning white in winter, and there is but one annual moult.

The members of this genus are the small, thickset rabbits commonly known as "Cottontails." As the generic name signifies, they are, often at least, frequenters of woods and brushy places, though this is not invariably the case, as some

species are also found on the open plains and prairies, and prefer such localities. They are found from Southern Canada south to Costa Rica. The genus has had many species and subspecies described and assigned to it, Nelson recognizing 54, of which five have been taken in Colorado.

KEY OF THE SPECIES.

- A. Ear short, 2.0–2.35 from notch.
 - a. Rostrum proportionately heavy, broad, and strongly angled on upper half of base; supraorbitals broad and heavy, and usually joined to skull at posterior end. Upper parts pale buffy grayish; tops of hind feet whitish; ears short, about 2. **S. f. similis**, p. 45
 - b. Rostrum proportionately long and slender, narrow, and not strongly angled on upper half of base; supraorbitals always light and slender, tapering to a narrow point nearly or slightly free from skull posteriorly, and inclosing a long narrow foramen.
 - a'. Ears longer, averaging from notch over 2.3; color darker. **S. n. pinetis**, p. 47
 - b'. Ears shorter, averaging less than 2.2 from notch; color lighter. **S. n. grangeri**, p. 49
- B. Ear long, 2.6 from notch.
 - a. Upper parts dark buffy; back of hind legs dull rusty brown; rump patch fairly well marked. **S. a. warreni**, p. 52
 - b. Upper parts pale buffy; rump patch obsolete; back of hind legs pale rusty. **S. a. baileyi**, p. 49

***Sylvilagus floridanus similis* (Lat. *similis*, like or similar).
Nebraska Cottontail.**

Sylvilagus floridanus similis Nelson, *Proc. Biol. Soc. Wash.*, xx., p. 82 (1907).

Type locality.—Valentine, Nebraska. (C. P. Streater, Nov. 10, 1894.)

Measurements.—(Type from Nelson, *l. c.*) Total length, 16.15; tail vert., 2.4; hind foot, 3.9; ear from notch in dried skin, 2.0.

Description.—Top of head and back pale pinkish buffy, grizzled with black on back; dull gray rump patch; sides of head and body grayer than back and not grizzled; top of tail dusky gray; nape rather pale rusty; pectoral band similar but paler; rest of under parts white; outside of ears gray, grizzled with dusky, with dusky

front border and tip; inside of ears grayish white; front and outside of fore legs, and back and outside of lower hind legs, rusty rufous, the hind legs being paler and more cinnamon.

The posterior portion of the postorbital process is quite wide, and lies close to the skull, leaving but a small foramen; the anterior end is very short, making only a small notch with the skull; the bullæ are rather small and smooth.

The only species whose range adjoins and overlaps that of this species is *baileyi*, and the broader postorbital process, with small foramen, smaller bullæ, shorter ear, and darker, brighter nape and pectoral band serve to distinguish it.

Distribution.—This species is found in extreme western Minnesota, eastern North and South Dakota, Nebraska, northern Kansas, and northeastern Colorado. Its distribution in Colorado is not as yet very well known; it is found along the Platte River and its tributaries to the base of the mountains near Denver, and has been taken at Dry Willow Creek, near Wray, Yuma County; Orchard, Morgan County; Barr, Adams County; Arvada, Jefferson County; Littleton, Arapahoe County; and Masters, Weld County.

Habits.—The habits of the various species of Cottontails

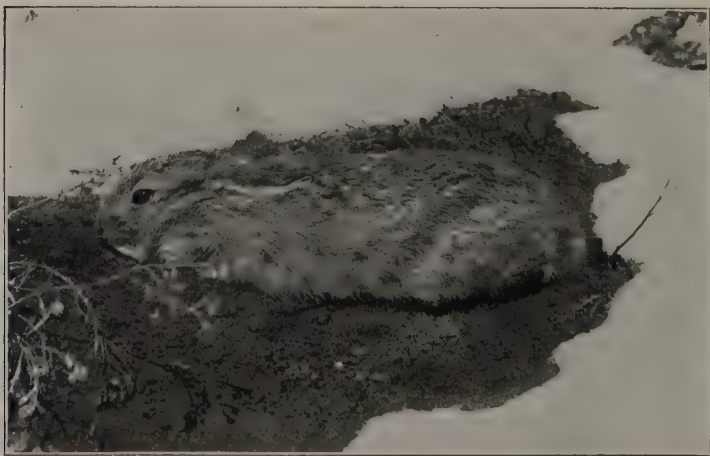


FIG. 14. YOUNG COTTONTAIL RABBIT: *Sylvilagus* SP.
Frightened, and crouching on the ground. Robt. B. Rockwell, Photo.

are very much alike in a general way, and may vary quite a little with the same species, according to its surroundings.

They may be found in brushy places, amongst weeds and grass, among rocks, out on the prairie, or in the timber. They live in holes, which they may dig for themselves, but the abandoned hole of a prairie dog or other animal is most commonly used. Frequently one may be seen squatting in a form under a weed or bush. The young are born in the burrows, and two or more litters are born each season; the number in a litter is from three to seven; they are born naked and blind, and suckled for three or four weeks, and then shift for themselves.

The Nebraska Cottontail, like other species of the *floridanus* group to which it belongs, is fond of brushy places when such are at hand, but at Barr, where there is practically no brush in which it can live, it was found along the banks of the large ditches, among the rank weeds, and also in old prairie-dog holes.

Sylvilagus nuttallii pinetis (*nuttallii*, for Thomas Nuttall, the naturalist; *pinetis*, denoting one living among pines). Rocky Mountain Cottontail.

Lepus sylvaticus pinetis Allen, *Bull. Amer. Mus. Nat. Hist.*, vi., p. 348 (1894).

Type locality.—White Mountains, south of Mount Ord, Arizona.

Measurements.—Total length, 15.75; tail vert., 2.0; hind foot, 3.9; ear from notch, 2.15–2.35.

Description.—(From a specimen taken at Lake Moraine, El Paso County, altitude 10,250 feet, January 14th.) Above, including top of head, a dark pinkish buffy, grizzled or marked with black; rump patch dull iron-gray; sides of head and body grayer and paler; nape rusty rufous; pectoral band similar, but paler; rest of underparts white; outside of ears grayish, grizzled, and with black border; upper side of tail brownish, grizzled with gray; front and sides of fore legs bright rusty rufous; back and outside of hind legs more cinnamon.

A specimen from the same locality, taken September 1st, is very much darker, more black on back, and especially on rump, which is blackish rather than gray; rufous patch on nape much larger; upper surface of tail with much rusty; pectoral band darker, more rufous.

The posterior portion of the postorbital process is slender and tapering and lying quite well away from the skull, leaving a good-sized foramen; anterior portion of process quite short and slender, making only a narrow notch with the skull; bullæ small and smooth.

The two species whose ranges touch and overlap that of *S. pinetis* are *baileyi* and *warreni*. From either one it may be distinguished by its shorter ear, smaller bullæ, and narrower postorbital processes. It is almost always darker and ruddier than *baileyi*, and while often dark and blackish, has never the black look that so many specimens of *warreni* have.



FIG. 15. ROCKY MOUNTAIN COTTONTAIL, *Sylvilagus n. pinetis*
E. R. Warren, Photo.

Distribution.—The Rocky Mountain Cottontail is found from central Arizona and middle western New Mexico north through Colorado, except the northwest corner. As its name indicates, it is an inhabitant of the mountains rather than the plains, and has been recorded in Colorado, from the higher parts of Larimer, Boulder, Jefferson, El Paso, Teller, Chaffee, Custer, Conejos, Costilla, Mineral, Saguache, Grand, Gunnison, Huerfano, La Plata,

Montezuma, Delta, Garfield, Eagle, Rio Blanco, and Routt Counties. It has a considerable range in altitude, from a little over 6,000 feet to 11,500 in the Pike's Peak region. The zonal range is mainly Transition and the lower edge of the Canadian, but also, as these elevations show, reaching well up into Hudsonian at times. In southwestern Colorado it overlaps the range of *S. warreni*, and in other parts of the state that of *S. baileyi*, and sometimes two species are found at the same locality.

Habits.—There is nothing specially characteristic about the habits of this species, except such as may be due to a difference in habitat. In the mountains it is found living in the timber and about fallen logs, also in the open spaces; and in Routt County I found it out on the open, more level ground.

***Sylvilagus nuttallii grangeri* (for W. W. Granger).**

Black Hills Cottontail.

Lepus sylvaticus grangeri Allen, *Bull. Amer. Mus. Nat. Hist.*, vii., p. 264 (1895).

Type locality.—Hill City, Black Hills, Custer County, South Dakota.

Measurements.—As in *pinetis*.

Description.—Color as in *pinetis* but paler, with rufous on legs brighter; ears somewhat shorter; skull narrower, with shorter rostrum and less interorbital breadth than *pinetis*, while the bullæ are somewhat larger.

Distribution.—This species is found in the extreme west Dakotas, most of Montana, Wyoming except the northwest part, extreme northwestern Colorado, most of Utah, southern Idaho, northern two thirds of Nevada, and just over the central part of the east boundary of California; it also ranges over the northern boundary of the United States into Alberta and Saskatchewan, Canada. The zonal range is mostly Transition and the upper half of the Upper Sonoran. In Colorado it has been taken at Meeker, Rio Blanco County; at Douglas Spring, Escalante Hills, and Lay, Routt County, while specimens from localities not far from these are more or less intermediate between *grangeri* and *pinetis*.

***Sylvilagus auduboni baileyi* (named for Audubon, and for Vernon Bailey).** Wyoming Cottontail. Bailey's Cottontail.

Lepus baileyi Merriam, *Proc. Biol. Soc. Wash.*, xi., p. 147 (1897).

Type locality.—Spring Creek, east side of Bighorn Basin, Wyoming. (Sept. 7, 1893, by C. Hart Merriam and Vernon Bailey.)

Measurements.—Total length, 15.5; tail vert., 2.2; hind foot, 3.7; ear from notch, 2.75.

Description.—(From a specimen taken near Colorado Springs, Nov. 7th.) Above, pale pinkish buff, mixed with black posteriorly; rump grayish, mixed with black; upper part of tail mixed gray, buffy, and blackish; sides grayish buffy; upper sides of front feet pale ochraceous buff; back and sides of hind legs similar but somewhat darker; nape pale rufous; pectoral band pale pinkish buff; rest of underparts white. A specimen taken June 29th, five miles west of the Snake River, Routt County, is in an intermediate stage of pelage, having moulted most of the old coat, but the new coat is short,



FIG. 16. WYOMING COTTONTAIL, *Sylvilagus a. baileyi*
Dorsal view of skull $\times 1\frac{1}{2}$

not having attained its full length. The whole back is brownish with white and gray-tipped hairs, little or no black, and the sides are a clearer gray, while the nape is a clearer, brighter rufous. The colors of this form vary considerably with locality, individuals, and season.

In the skull the postorbital process is rather broad posteriorly and encloses a well-marked oval foramen; the anterior portion is fairly long, and makes a deep notch; the bullæ are moderate in size and rather rough.

Distribution.—The Wyoming Cottontail is found in eastern

Montana, Wyoming, western North and South Dakota, Nebraska, Kansas as far east as Trego County, Colorado, and northeastern Utah, having a vertical range from 3,000 to 7,000 feet, being mainly in the arid Upper Sonoran zone, but also reaching lower Transition. In Colorado it is found over the plains region east of the foothills, and up the Arkansas River at least as far as Salida, and in the lower portions of Routt and Rio Blanco Counties. In the northeastern part of the state its range is mingled, to some extent at least, with that of the Nebraska Cottontail, and the two species are found in the same localities at times. In the foothills, and also in Routt and Rio Blanco Counties, it meets the range of the Rocky Mountain and Black Hills Cottontails, and in some localities two species have been taken together. It has been taken in Larimer, Jefferson, Elbert, Denver, Arapahoe, El Paso, Morgan, Kit Carson, Fremont, Baca, Chaffee, Routt, and Rio Blanco Counties.

Habits.—The Wyoming Cottontail is fonder of the open



FIG. 17. WYOMING COTTONTAIL, *Sylvilagus a. baileyi*

In form under sage-brush. Photographed near Douglas, Wyoming, by E. R. Warren. The rabbit's face can be seen near the lower part of the picture, a little to the right of the centre

country than of the thick brushy places, though it may be found there also, but is really an inhabitant of the plains by

preference. It is found on the prairies, living in abandoned prairie-dog or badger holes, or living about the rabbit brush, sage-brush, or greasewood so common in many localities. It is also found among rocks on the hillsides, and the ledges which often border the streams and gulches, so that after all it may be said to be rather indiscriminate in its choice of a residence.

***Sylvilagus auduboni warreni* (for E. R. Warren).**

Colorado Cottontail.

Sylvilagus auduboni warreni Nelson, *Proc. Biol. Soc. Wash.*, xx., p. 83 (1907).

Type locality.—Coventry, Montrose County, Colorado (C. H. Smith, January 4, 1907).

Measurements.—Total length, 15.5; tail vert., 2.0; hind foot, 3.8; ear from notch, dried skin, 2.75.

Description.—(From a specimen taken at Coventry, Dec. 15th.) Back a dark pinkish buff much mixed with black; rump gray with much black; sides buffy, rather gray next back, but clear buff adjoining belly; upper part of tail gray, mixed with blackish; nape and front legs rufous, quite dark; pectoral band pinkish buffy; rest of underparts white. Some specimens have so much black on the back that the posterior portion might almost be said to be that color, it is so much in evidence. Specimens from Cortez, Montezuma County, in my collection, have the rufous of the neck and feet very dark and intense.

The skull is as in *baileyi*.

The darker color distinguishes this species from *baileyi*, which has a similar skull, and while *pinctis*, the only other whose range approaches it, is often quite dark, the two are readily distinguished by cranial characters, and especially by the difference in the size of the bullæ, *warreni* having much the larger, and also longer ears.

Distribution.—The Colorado cottontail is found, according to Nelson, in "southwestern Colorado, and adjacent parts of Utah, New Mexico, and Arizona." In Colorado we have it from Montrose, Montezuma, San Miguel, Mesa, Delta, Garfield, Conejos, Costilla, and Saguache Counties. It ranges from below 5,000 to 8,000 feet, mainly in the Upper Sonoran, but extending into both Lower Sonoran and Transition. It has been found in the valley of the Grand River up at least as far as Rifle, and is separated from the range of the Wyoming Cottontail to the north by the divide

between the Grand and White Rivers, which is no doubt occupied by the Rocky Mountain Cottontail.

Habits.—In the localities where I have had an opportunity to observe this species it was found in the sage-brush and greasewood of the mesas and bottoms; among the rocks of the hillsides and cañons; and in the cedar and piñon woods; any place seemed to suit it. The breeding season begins in March in Montezuma County.

Family OCHOTONIDÆ

Small Guinea-pig-like forms with small eyes, broad and round ears, and subequal limbs with five toes in front and four behind, and no external tail; skull depressed and without postorbital processes; incisors large, the upper ones deeply grooved in front; molars as in *Leporidae*.

A small family containing only one genus, found at considerable elevations in Asia and North America.

Genus OCHOTONA (Mongol name of the Pika)

Ochotona Link, *Beitr. Nat.*, i., pt. ii., p. 74 (1795). Type *O. ochotona*.

Revision, Lyon, *Smithson. Misc. Coll.*, xlv., pp. 321-447 (1904).

Skull above broad posteriorly, with a slight sagittal crest narrowing anteriorly; anteorbital constriction considerable; malar prolonged almost to auditory opening; dentition, i. $\frac{2}{1}$; p. $\frac{2}{2}$; m. $\frac{3}{3} \times 2 = 26$; upper incisors broad, long and with a deep groove on the outer side, dividing each tooth into unequal halves, and terminating in two points, the cutting edge being deeply notched and gouge-shaped instead of chisel-shaped; lower molars deeply grooved on the sides, causing the salient angles to be very prominent.

Alpine and Boreal animals, found in both the New and Old Worlds. Seven species are known in North America, one only in Colorado,

Ochotona saxatilis (Lat., that dwells among rocks).

Cony. Pika.

Ochotona saxatilis Bangs, *Proc. New Eng. Zool. Club*, i., p. 41 (1899).

Type locality.—Snowy Range, Montgomery, Park Co., Colorado.

Measurements.—Total length, 7.60; hind foot, 1.25.

Description.—(From specimen taken Oct. 15th, at Crested Butte.) Above mixed gray, black, and a little ochraceous ("pepper and salt" describes the combination very well); sides a pale buffy ochraceous, as also sides of head. Chin and throat pale buffy, belly buffy white. The fur looks and feels like that of a rabbit, and the skin is very thin and tender, as in a rabbit.

Distribution.—This species has been reported from Colorado only; it is confined to the mountains, usually ranging from 9,000 feet up to above timber-line, its range being governed very much by the presence of slide rock amongst which it prefers to live; and it is the presence of slide rock that occasionally brings it down to lower elevations. The lowest we have heard of is No Name Creek near Glenwood Springs, where it comes down to between 7,000 and 8,000 feet, having followed down a slide from the mountains. It is seemingly found in all our mountain counties.

Habits.—As will be inferred from the account of the distribution conies are rock-loving creatures, and it is among the rocks that they live, and in the slide rock when there is any, for amongst its numberless cracks and crevices they find dwellings and refuges without end. The food is exclusively vegetable, and consists of any of the plants growing where they live. Besides eating these plants from day to day to satisfy immediate needs, conies store considerable quantities of these plants, making little hay-piles among the rocks; these piles often contain a bushel or more of food, and are usually shaped like a haystack, though sometimes the "hay" is piled under the rocks, instead of on top. This is probably a winter food supply, but little is known of their winter habits. These high altitudes in our snowy mountains are not safe places to be investigating the life histories of an animal in winter, when a snowslide is liable to come along and put

a sudden stop to the investigating and the life of the investigator as well. But they do not seem to hibernate, and



FIG. 18. CONY, OR PIKA. *Ochotona saxatilis*
E. R. Warren, Photo.

can doubtless make their way about under the snow and through the slide rock. I have seen one about in January, at a mine near Irwin, at an elevation of 10,700 feet; there it came inside the blacksmith shop, but gave no opportunity to study its habits. In late summer and in fall the conies may be seen busily engaged in gathering their hay crop. The method is to cut down as much of the plant as can be taken into the mouth, then getting hold of the bunch at the ends of the stalks, the cony starts on a run for his haystack. He never walks, he is in too great a hurry to get in his hay. This load is placed on the pile, and away he goes after another. Where there is a rock slide of considerable extent sometimes several conies may be seen at once making hay.

While perhaps not social animals in the strict sense of the word, yet every large rock slide has usually several of them dwelling there, and the inhabitants may be seen, when not making hay, sitting about on rocks in the sun, taking life easy. They have a curious little cry, difficult to describe, but it is a jerky, squeaky sort of noise, and is frequently heard when the animals are out on the rocks. As a rule they



FIG. 19. "HAY PILE" OF CONY, *Ochotona saxatilis*
E. R. Warren, Photo.

are not shy, and by careful walking may be approached quite closely.

But little seems to be known of the breeding habits; the young are born during the summer, but the number is not known. The mammae are six in number and it is not likely that a litter exceeds that number, and four or five are most likely to be the average.

SUBORDER SIMPLICIDENTATA

With only two incisors in the upper jaw, the enamel

covering of which is confined to the front surface; incisive foramina of moderate size and distinct from one another; fibula not articulating with the calcaneum.

Family ERETHIZONTIDÆ

Somewhat bulky animals with subequal limbs and short stumpy tails with portions of the hairy covering modified into long sharp spines; skull short and broad, the jugal without inferior angle; the anteorbital foramen large; molars more or less completely rooted with internal and external enamel folds.

This family is confined to the North American Continent.

Genus ERETHIZON (Grk. *erethizein*, to excite, irritate, in allusion to the quills).

Erethizon F. Cuvier, *Mem. du Mus.*, ix., p. 426 (1822).

Bulky rodents of considerable size, having part of the hair modified

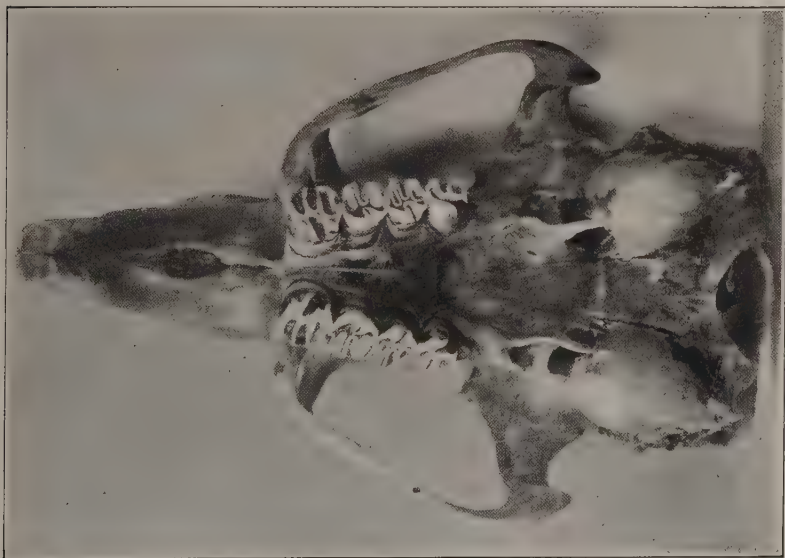


FIG. 20. YELLOW-HAIRED PORCUPINE, *Erethizon epixanthus*
Skull, showing dentition, nearly natural size

into quills or spines; four toes on front feet, five on hind feet, all with strong claws; limbs short and strong; tail short, thick, non-prehensile, covered above with stiff hairs and spines, and on the sides and beneath with stiff bristles.

Skull with facial portion short; dentition, i. $\frac{1}{1}$; p. $\frac{1}{1}$; m. $\frac{3}{3} \times 2 = 20$.

There are two species and four subspecies of porcupines found in the timbered regions of North America, only one being found in Colorado.

Erethizon epixanthum (Grk. *epi*, upon, *xanthus*, yellow).

Yellow-haired Porcupine.

Erethizon epixanthum Brandt, *Mem. Acad. St. Petersb.*, 1835, p. 389, pl. i., 9.

Type locality.—California(?) Unalaska(?)

Measurements.—Total length, 32; tail vert., 6.8; hind foot, 4.25.

Description.—(From a specimen taken near Sheephorn Pass, Grand County, May 20th): The general appearance of the animal is black and a somewhat greenish yellow, due to the long outer hairs, which project three inches beyond the quills and short hairs, and are black with an inch or more of the tips yellow. These long hairs are wanting on the rump. The quills are yellowish with blackish tips, and are found all over the sides and upper parts, including tail, but not on nose. Mingled with the quills are short black hairs. Sides of belly with yellow hairs, middle with black. The long black and yellow hairs are found on the legs and feet except the soles which are naked and black.

Distribution.—Elliot, in his Check-list, gives the range of this species as "State of Sonora, Mexico, into New Mexico, eastward to Missouri, west to the Pacific, and north to Alaska and the limit of trees."

In Colorado it is found through the timbered portions of the State, which thus confines it pretty well to the mountains, through which it is generally distributed, and quite common in many places, and seems to be most abundant in the higher altitudes, from 9,000 feet up.

Habits.—Porcupines are tree-loving animals, and are seldom found any distance from the woods; with their long stout claws they are good climbers, and spend much of their lives in the trees. Their food is vegetable, and consists of the bark of trees, grass, and any fruits they are able to

obtain. While largely of nocturnal habits, yet they are quite frequently seen abroad during the day. They make their homes in holes among rocks, in hollow trees, or other cavities which they may find and fancy.

They breed in the early summer, and two seems to be the usual number of young.

Thanks to their defensive armor of quills, porcupines have



FIG. 21. YELLOW-HAIRED PORCUPINE, *Erethizon epixanthus*
E. R. Warren, Photo.

but few enemies; in our State they are killed by mountain lions, and very possibly by coyotes and bobcats. It is probable that this is done only in winter when other food is scarce. I have

been told of mountain lions being killed by hunters which were so weak that they made no attempt to escape, and examination showed the stomach to be perforated by porcupine quills, which were the cause of the animals' weakness. When one considers the fact that the only unprotected portions of a porcupine are the under parts, it seems strange that any animal



FIG. 22. YELLOW-HAIRED PORCUPINE, *Erethizon epixanthus*.
The same individual as in Fig. 21, but higher up the tree.

should be able to kill one without getting paws and nose filled with quills. The remains of porcupines which have been killed by other animals generally consist of the skin and perhaps a few bones and part of the entrails; the skin shows that the victim had been turned on its back and opened on

the belly, but it is more than likely that even then some of the quills would find their way into the stomach.

In spite of their generally harmless and inoffensive ways, porcupines at times do considerable damage about miners' cabins which are left vacant and into which they have succeeded in gaining an entrance in some manner. Everything wooden is apt to be well gnawed before the animal is done with the place. The attraction seems to be the salty taste of the articles resulting from human handling, and of course there are often many things about these places which have had salty articles in them, and these, such as butter-tubs, are almost devoured entirely. So disliked are they for this habit that many men think it best to kill a porcupine on sight just to keep it out of mischief. Although they gnaw much bark on trees, especially in winter, this does not appear to harm the trees, at least permanently, as they are never completely girdled, so far as my observations go.

Family ZAPODIDÆ

Terrestrial rodents with small internal cheek pouches and with long hind limbs adapted for jumping, in which the metatarsals are separated and the toes five in number; tail longer than the head and body; upper incisors compressed and grooved in front; pm. $\frac{1}{6}$ small; molars rooted.

A small family confined to North America, excepting one species.

Genus ZAPUS (Grk. *za*, intensive + *pous*, foot)

Zapus Coues, *Bull. U. S. Geol. Sur. Terr.*, i., 2d Ser., No. 5, p. 253 (1875).

Type.—*Dipus hudsonius*.

Revision, Preble, *N. A. Fauna*, No. 15 (1899).

Body enlarged posteriorly; hind legs and tail greatly developed, the latter much exceeding the length of head and body; tail slender, uniformly tapering; first digit of the hand rudimentary, nail blunt; pelage coarse; upper parts ochraceous with dark dorsal band; under parts white.

edges of woods, and in shrubby fields, and show a preference for moist ground. They build nests of grass, sometimes under ground, and sometimes on the surface in the grass or small bushes. Preble says that in late summer they build a globular nest of grass above ground, and that this is usually inhabited by two individuals, presumably a pair. This is

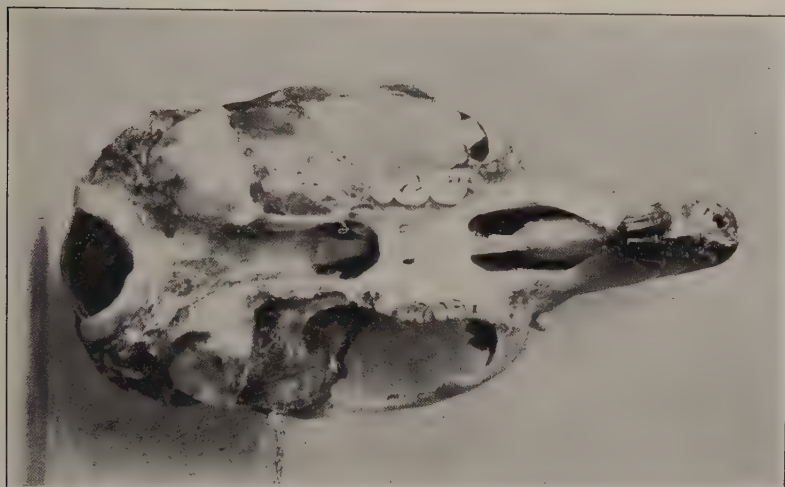


FIG. 23. ROCKY MOUNTAIN JUMPING MOUSE, *Zapus princeps*
Skull, showing dentition, $\times 4$ nearly

after the close of the breeding season. The breeding season is in May or June, and five or six young are born. Litters of young have, however, been found in late September, showing that it may breed through the summer. The food is seeds and other vegetable matter.

Jumping Mice hibernate, but may in mild weather come out for a short time. The hibernation takes place in holes under ground.

Zapus princeps (Lat., chief). Rocky Mountain Jumping Mouse.

Zapus princeps Allen, *Bull. Am. Mus. N. H.*, v., p. 71 (1893).

Type locality.—Florida, La Plata Co., Colo.

Measurements.—Total length, 9.5; tail vert., 5.75; hind foot, 1.3.

Description.—(From a specimen taken at Meeker, Rio Blanco Co., July 7th.) Sides ochraceous buff mixed with blackish, except a clear



FIG. 24. ROCKY MOUNTAIN JUMPING MOUSE, *Zapus princeps*.

About $\frac{1}{2}$ life size. E. R. Warren, Photo.

narrow lateral line next the white underparts; dorsal area very dark, the black hairs largely predominating; under parts white with but a faint tinge of buffy in some places; tail bicolor, dusky above, grayish white below. The larger size, darker dorsal area, whiter underparts, and whitish underside of tail serve to distinguish it from *Z. h. campestris*.

Distribution.—The Rocky Mountain Jumping Mouse is a mountain form, and has been reported from Alberta, British Columbia, Montana, Idaho, Wyoming, Colorado, and New Mexico. In Colorado it is recorded from La Plata, Saguache, Costilla, Boulder, Gilpin, Gunnison, Routt, and Rio Blanco Counties. Its range of elevation as known to me is from 6,000 to 10,000 feet. It is no doubt found through all the mountainous portion of the State.

Family HETEROMYIDÆ

Rodents with large fur-lined cheek pouches opening outside

of the mouth on either side of the head; eyes large, and ears moderately so; elongated hind limbs and tails; skull with the mastoids largely developed and appearing at the top of the cranium; zygomata slender; incisors narrow; molars rooted or rootless.

This family is chiefly distributed over western North America, some genera reaching south of Panama.

Subfamily HETEROMYINÆ (Pocket Mice)

Very small forms with rooted molars and hind limbs only moderately lengthened.

A small family confined to the New World.

Subfamily DIPODOMYINÆ (Kangaroo Rats)

Larger forms with rootless molars; skull triangular in shape with the mastoid enormously inflated; hind limbs very long with four or five toes.

KEY OF THE COLORADO GENERA OF HETEROMYIDÆ

- A. Molars rooted and tuberculate; tail shorter, less than $\frac{1}{2}$ total length. (Pocket Mice) **Perognathus**, p. 65.
- B. Molars rootless and without reentrant angles; tail elongated, more than $\frac{1}{2}$ total length. (Kangaroo Rats) **Perodipus**, p. 71.

Genus PEROGNATHUS (Grk. *pera*, pouch + *gnathus*, jaw)

Perognathus Maximilian; *Nov. Act. Acad. Cæs. Leop. Carol.*, xix., pt. 1, p. 369 (1839). Type *P. fasciatus*.

Revision, Osgood, *N. A. Fauna*, No. 18 (1900).

This genus contains the Pocket Mice; these are desert-loving rodents of medium or small size with large swollen heads owing to the great development of the externally opening cheek pouches; the ears are small, and the tail is of moderate length, in Colorado species not exceeding by much if any the length of the head and body; the hind limbs are elongated, but not nearly to so great an extent as in *Perodipus*.

In coloration the upper parts are of varying shades of buff grizzled with black, the under parts white or nearly so; there is but

little seasonal change of color, the single annual moult taking place in late summer after the breeding season.

In the skull the bullæ are not as large as in *Perodipus*, but do reach the upper side of the skull, while the zygomata are better developed and have their roots free from the bullæ.

Dentition: i., $\frac{1}{4}$; pm. $\frac{1}{4}$; m. $\frac{3}{8} \times 2 = 20$; incisors grooved; molars rooted and tuberculate.

This genus contains according to Elliot's Check-list 34 species and 30 subspecies ranging over the western half of North America in the Sonoran and Transition Zones from British Columbia to the Valley of Mexico, and from the Great Plains at about Lon. 97° westward to the Pacific. Only six species have hitherto been met with in Colorado.

KEY TO THE SPECIES

- A. Of smaller size, total length under 6.0; swollen portion of the mastoid bones projecting beyond the plane of the occiput; interparietal bone very small, its width less than the interorbital space (subgenus *Perognathus*).
 - a. Larger, length 5.0 or a trifle over.
 - a'. Under parts buff. **P. fasciatus infraluteus**, p. 67.
 - b'. Under parts white.
 - a''. Color above pale buffy, with a rufous tinge, lightly lined with black. **P. apache**, a, p. 69.
 - b''. Ground color as above, but back very dark, blackish, sides clear rufous-tinged buff. **P. apache**, b.,¹ p. 69.
 - c''. Ground color above pale buffy, moderately lined with black, tail gray. **P. flavescens**, p. 68.
 - d''. Darker; grayish buff above, heavily lined with black; tail buffy. **P. callistus**, p. 68.
 - b. Smaller; length $4\frac{1}{2}$ or less. **P. flavus**, p. 70.
- B. Of large size, total length over 8.0; swollen portion of the mastoid bones not projecting beyond the plane of the occiput; interparietal bone as wide as the frontals at the interorbital space (subgenus *Chatodipus*).
 - P. hispidus paradoxus**, p. 70.

¹ Specimens from southwestern Montrose County come under this head.

Perognathus fasciatus infraluteus (Lat. *fascia*, a band;
infra, below + *luteus*, yellow or buff). Buff-bellied
Pocket Mouse.

Perognathus infraluteus Thomas, *Ann. Mag. Nat. Hist.*, 6th ser.,
xi., p. 406 (1893).

Type locality.—Loveland, Larimer Co., Colo.

Measurements.—(From Osgood): Total length, 5.0; tail vert.,
2.32; hind foot, 0.67.

Description.—(From specimen taken at Loveland, Larimer
Co., Colo., Oct. 19, 1894, B. S. No. 69345). Buff above, heavily
and uniformly lined with black, except on sides, white spots over
eyes, and back of ears; under parts buff; tail like back. The buff
under parts distinguish it from all other Colorado species.

Distribution.—The Buff-bellied Pocket Mouse has thus far been
taken at the type locality only, which is Loveland, Larimer County,
Colorado.

Habits.—The various species of Pocket Mice are of similar
habits. These are not as well known as they might be,
as the animals are of nocturnal habits and live in burrows,
so that they are but seldom seen during the day. Their
burrows are small in size, and from their mouths little
mounds of earth are thrown out, and as in the case of the
kangaroo rats, the entrances are usually closed with earth
during the day, much more invariably than with the rats, at
least in such cases as have come under my observation. The
burrows have two or more entrances, and these often open
under a weed or bush. Yuccas are favorite places, and where
there are clumps of prickly pear plants (*Opuntia*) there will
be found the holes of the Pocket Mice, if any are about.
Their food consists of seeds, which are carried to their store-
rooms in the cheek pouches. They are not known to hiber-
nate. They rather prefer sandy soil.

But little is known about their breeding but this takes
place in the spring and very likely through the summer.
Four or five young are produced at a birth.

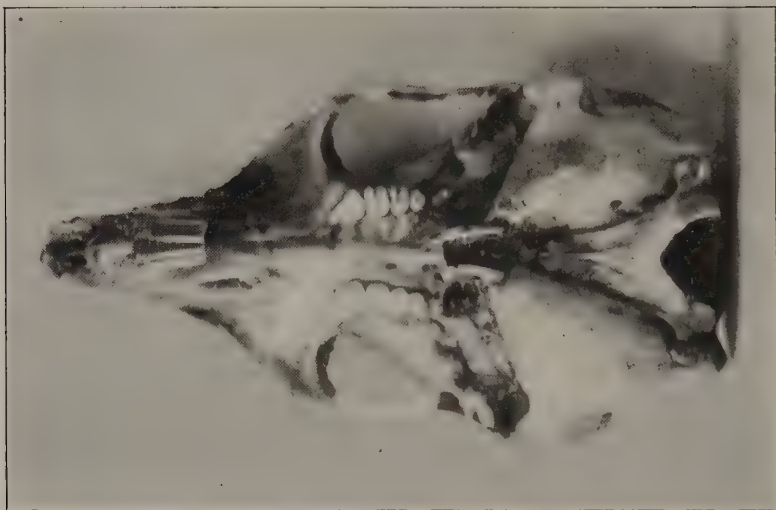


FIG. 25. PLAINS POCKET MOUSE, *Perognathus flavescens*
Skull, showing dentition, x $3\frac{1}{2}$

Perognathus flavescens (Lat. *flavescere*, to become yellow).
Plains Pocket Mouse.

Perognathus fasciatus flavescens Merriam, *N. A. Fauna*, No. 1, p. 11 (1889).

Type locality.—Kennedy, Cherry Co., Nebr. (V. Bailey, June 11, 1888).

Measurements.—Total length, 5.1; tail vert., 2.4; hind foot, 0.7.

Description.—(From a specimen taken at Colorado Springs, Dec. 7): Above pale buff, moderately lined with black, except on sides, which are clear; under parts white; tail grayish white. The whitish tail distinguishes it from *P. callistus*, which otherwise resembles it quite closely.

Distribution.—The Plains Pocket Mouse is recorded from Nebraska, Kansas, Colorado, South Dakota, and New Mexico. In Colorado, judging from the records at hand, it is confined to the plains region east of the mountains, being recorded from Boulder, Weld, Adams, Logan, El Paso, and Pueblo Counties.

Perognathus callistus (Grk. *kallistos*, beautiful). Beautiful
Pocket Mouse.

Perognathus callistus Osgood, *N. A. Fauna*, No. 18, p. 28 (1900).

Type locality.—Kinney Ranch, Bitter Creek, Sweetwater County, Wyoming (J. A. Loring; May 14, 1897).

Measurements.—(From Osgood): Total length, 5.3; tail vert., 2.5; hind foot, 0.7.

Description.—(From specimen taken at Kinney Ranch, Sweetwater Co., Wyo., May 12, topotype, B. S. No. 87905): Above a grayish buff, moderately lined with black, except a lateral line; under parts white; tail buffy. This species is about as dark as *flavescens*, but looks grayer, and has the tail buffy, not whitish or gray.

Distribution.—The Beautiful Pocket Mouse is positively known only from the type locality and vicinity, Kinney Ranch, Bitter Creek, Sweetwater County, Wyoming. It has been included tentatively among the mammals of Colorado because both Cary and Warren found evidences of Pocket Mice in the Snake River country in western Routt County, and this is the species whose range is nearest to that locality. That this supposition is probably correct is strengthened by the fact that two other species of mammals, the Cinnamon Woodrat and Wortman's Ground Squirrel, having the same type locality, have been taken in Routt County.

Habits.—The signs of these animals referred to above were seen about bunches of prickly pear cactus.

Perognathus apache (named for Apache County, or the Indians of that name). Apache Pocket Mouse.

Perognathus apache Merriam, *N. A. Fauna*, No. 1, p. 14 (1889).

Type locality.—Kear Canyon, Apache County, Arizona.

Measurements.—(From Osgood): Total length, 5.5; tail vert., 2.65; hind foot, 0.7.

Description.—(From a specimen taken at Kear Canyon, Arizona, Aug. 3, 1894; A. K. Fisher): Above bright buff with rufous tinge, very sparsely and finely lined with black; under parts white; upper side tail buffy gray, paler below. The rufous-tinged buff color, with but little black lining, at once distinguishes this from all other Colorado species. Specimens from Bedrock and Coventry, southwestern Montrose County, are somewhat different, being very dark, blackish almost, on the back, with clear, bright rufous-tinged buff on the sides—a color phase akin to that of the Golden Pocket Gopher and Moki Kangaroo Rat from the same localities.

Distribution.—The Apache Pocket Mouse is found in eastern Arizona, western New Mexico, southern Utah, and southwestern Colorado. In Colorado it has been taken at Balzac, Garfield

County; near Fruita, Mesa County; and Coventry and Bedrock, Montrose County. The Montrose County specimens are dark colored, and resemble the form called by Osgood *P. apache melanotis*, the type of which came from Chihuahua, Mexico, but which seems to have no well defined distribution, having been taken here and there in various places in Arizona and New Mexico, and frequently in localities not far removed from those where the typical form is found. It has also been taken at Medano Ranch, Costilla County.

***Perognathus flavus* (Lat., golden yellow). Baird's Pocket Mouse.**

Perognathus flavus Baird, *Proc. Acad. Nat. Sci. Phila.*, p. 332 (1855).

Type locality.—El Paso, Texas.

Measurements.—Total length, 4.5; tail vert., 2.0; hind foot, 0.62.

Description.—(From a specimen taken at Springfield, Baca Co., Colorado, April 20): Above pale buffy, lined with black, much as in *P. flavescens*; a large clear buff post-auricular spot; under parts white; tail grayish white.

Distribution.—Baird's Pocket Mouse has been taken in Texas, Oklahoma, New Mexico, Colorado, Nebraska, and Chihuahua, Mexico. In Colorado it has quite a wide distribution, having been taken in Kit Carson, Adams, Weld, Larimer, El Paso, Fremont, Chaffee, Costilla, Prowers, and Baca Counties. The highest elevation of which we have a record is Fort Garland, at nearly 8,000 feet. The list of counties shows a distribution over the entire plains region and up the Arkansas River to Salida; while the Costilla County records show that it is found in the San Luis Valley, though over how great a portion of it remains to be seen.

Habits.—A female taken in Baca County, April 20, contained four embryos.

***Perognathus hispidus paradoxus* (*hispidus*, Lat., rough, bristly; *paradoxos*, Grk., an incredible statement, a paradox). Kansas Pocket Mouse.**

Perognathus paradoxus Merriam, *N. A. Fauna*, No. 1, p. 24 (1889).

Type locality.—Trego County, Kansas (A. B. Baker, Oct. 17, 1884).

Measurements.—(From Osgood *l. c.*): Total length, 8.75; tail vert., 4.25; hind foot, 1.05.

Description.—(From a specimen taken at Monon, Baca Co.,

Colo., May 5.): Above buffy ochraceous, mixed with black, except on sides which are clear buffy; under parts white; tail bicolor, dusky above, white below. The large size of this species at once distinguishes it from all other Colorado pocket mice.

Distribution.—The Kansas Pocket Mouse has a wide range, as is shown by the fact that it is recorded from Arizona, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Chihuahua, Mexico. In Colorado it inhabits the plains region, but as yet we have only a few records, widely scattered, from Logan, Boulder, and Baca counties. But the location of these three counties is such as to practically cover the whole region east of the foothills.

Habits.—In one respect this species sometimes differs in its habits from other members of the genus, and that is that very frequently there are no mounds of earth about their holes, which may go straight down into the ground out on the open prairie instead of being under a yucca or something of that sort. Bailey says that the absence of earth at these holes is accounted for by the fact that they are not the main entrances to the burrows, and that at the main entrance there is always a mound, often of considerable size, all the earth having been brought out that way.

Genus PERODIPUS (Grk. *pera*, a pouch, + *di*, two, + *pous*, footed, in allusion to the pouches and long hind legs).

Perodipus Fitzinger, *S. B. Math. Nat. O. K. Akad. Wiss. Wien*, lvi., p. 126 (1887). Type, *P. agilis*.

Rodents with elongated hind limbs and tails, the latter hairy and pencilled at the tip and longer than the head and body, the former with elongated hairy soles and 5 clawed toes, the first small but distinct and always reaching the end of the metatarsus of the other digits; cheek pouches well developed, ears moderate, and fur soft and velvety.

Skull flat and depressed, characterized by the enormously enlarged auditory bullæ which appear on the upper surface and fill up the two posterior corners, displacing the other bones while below they touch each other across the basisphenoid; zygomatic arches very slender and nearly straight, posteriorly in contact with the bullæ; infraorbital foramen rounded and placed nearer the incisors on the side of the rostrum than the root of the zygoma. Dentition:

i., $\frac{1}{1}$; pm., $\frac{1}{1}$; m., $\frac{2}{2} \times 2 = 20$; incisors narrow, clearly marked with a median groove; molars simple, transversely elongated without reëtrant angles.

All the species have certain markings in common, as follows; more or less distinct crescentic black facial lines; side of mouth, spot over eyes and behind ear, white; and a white stripe across thigh usually reaching the tail.

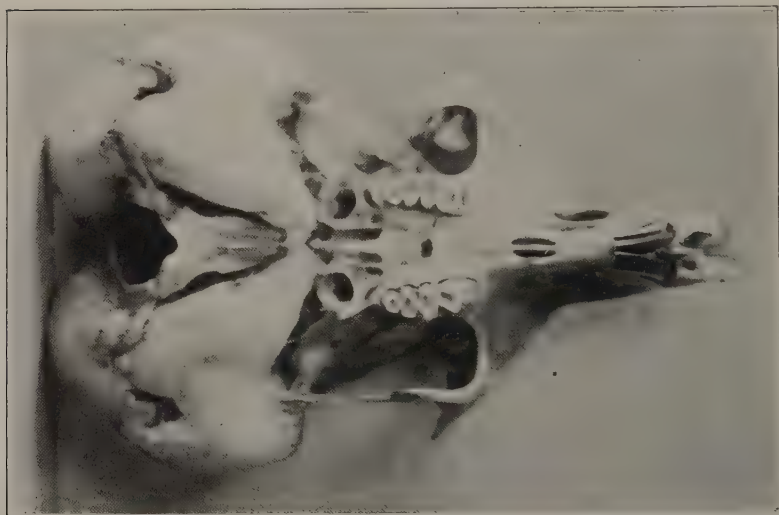


FIG. 26. MOKI KANGAROO RAT, *Perodipus longipes*
Skull, showing dentition, $\times 2\frac{1}{2}$

This genus contains the five-toed Kangaroo Rats and ranges over the western half of the United States from Oregon and Nebraska southwards into Mexico as far as the State of San Luis Potosi.

Elliot gives a list of 16 described species in his Check-list; of these three have been met with in the State of Colorado.

KEY TO SPECIES OF PERODIPUS

- A. Color pure, bright buffy. *P. longipes*, a, p. 77.
- B. Color dusky. *P. longipes*, b,¹ p. 77.

¹ This is a dark form of *longipes* found in southwestern Montrose County.

- C. Color darker buffy, lined with black.
- a. Darker of this group, dull buffy ochraceous, lined with blackish hairs; under tail stripe continuous to pencil.
P. montanus, p. 73.
 - b. Ground color paler, brighter buffy, but more heavily lined with dark hairs; under tail stripe not continuous to pencil.
P. montanus richardsoni, p. 76.

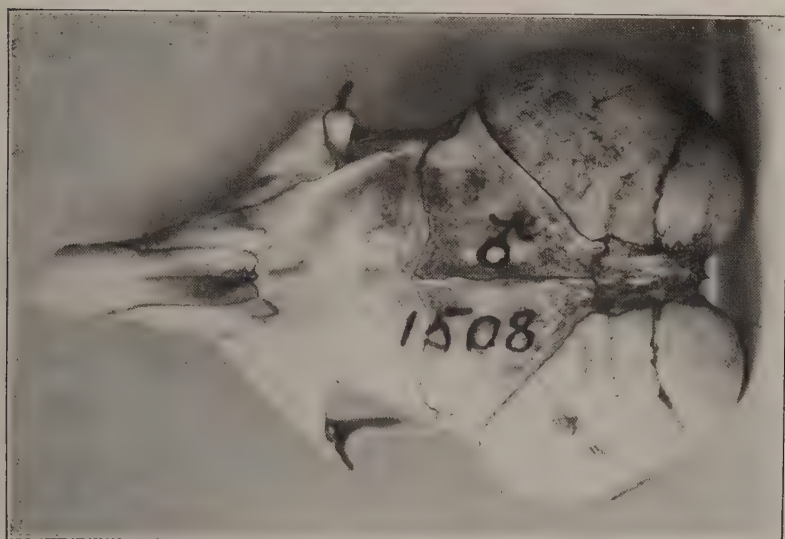


FIG. 27. MOKI KANGAROO RAT, *Perodipus longipes*
Dorsal view of skull, $\times 2\frac{1}{2}$

Perodipus montanus (Lat., belonging to or living in the mountains). Mountain Kangaroo Rat.

Dipodomys montanus Baird, *Proc. Acad. Nat. Sci. Phila.*, vii., p. 365 (1855).

Type locality.—Near Fort Garland (old Fort Massachusetts), Costilla County, Colorado (F. Kreutzfeldt).

Measurements.—(From Merriam): Total length, 9.8; tail vert., 5.5; hind foot, 1.6.

Description.—(From specimen taken on Conejos River, Colo., Sept. 3, B. S. No. 133662): Above a dull buffy ochraceous, darker

than in *longipes*, and quite heavily lined with black; tail stripes dark, rather blackish, and continuous to pencil, but Merriam states that the lower stripe is often absent beyond end of vertebræ. Under parts white. Post-auricular spot large.

Distribution.—The Mountain Kangaroo Rat has been recorded from Colorado only, and in this State the only record is at present Costilla County, and the extreme southern part of Saguache County, but it is no doubt the species inhabiting that portion of the San Luis Valley suitable for these animals. It attains an elevation of nearly 8,000 feet at Fort Garland and Crestone.

Habits.—The different species of Kangaroo Rats all have very similar habits, and the following description will serve for them all. They are burrowing animals, and are of social habits to a certain extent, being usually found in colonies



FIG. 28. MOUNTAIN KANGAROO RAT, *Perodipus montanus*
E. R. Warren, Photo.

of varying numbers. These burrows are of considerable length, one opened by Frank Stephens in California having a total length of fourteen feet, and besides this main tunnel there were several short side branches, each terminating in a chamber, which was used either as a storeroom, or as a

nest. The main tunnel varied from six to eighteen inches below the surface, and was about two inches in diameter. The animals throw out mounds of earth at or near the entrances of their holes and during the day the entrance to the hole is often closed by earth to keep out such enemies as snakes, but this is not invariably the case, for one often finds burrows with open entrances. The entrance to a burrow is usually under a bush or plant of some kind; if there are yuccas the hole will be found there very often, as the sharp pointed leaves of this plant are a great protection against the pursuit of such an enemy as a coyote which might otherwise seize a rat just as it was about to dive into the hole. The holes have usually two or more entrances, and there may be an entrance at each end of a burrow. One often finds several holes under a yucca or sage-brush, and these seem to belong to one burrow. In a locality where the animals are plentiful there will be seen trails or roads as one may well call them, so well beaten are they at times, leading from one hole to another, and about the neighborhood. In these trails can be seen the tracks of the makers, not only the foot-marks but a long streak in the sand which shows where the tail has been dragging on the ground. They progress by leaps, as one would infer from the long hind legs, but one which two of us caught at San Luis Lake ran on all fours without leaping.

Kangaroo Rats are nocturnal in their habits, though occasionally seen in the daytime. Their food is seeds of various kinds, and they do not refuse grain when they can get it, but it is doubtful if they are injurious to the farmer, except in an occasional instance when they have access to a grain stack, when they may possibly carry a considerable amount to their storerooms. But this in most cases would be counterbalanced by the large number of weed seeds eaten by the animals, for these constitute the greater part of their food.

Not very much has been published about their breeding habits but the young are born mostly in spring and also to a certain extent in summer and fall and three or four form a litter.

Perodipus montanus richardsoni (for Jenness Richardson).
Richardson's Kangaroo Rat.

Dipodops richardsoni Allen, *Bull. Am. Mus. N. H.*, iii., p. 277 (1891).

Type locality.—Sources of Beaver River, in northwestern corner of Indian Territory (now Oklahoma).

Measurements.—Of large series from Baca Co., Colorado Springs, and other parts of eastern Colorado, practically same as *P. montanus*. Specimens from Salida larger, total length, 10.40; tail vert., 3.95; hind foot, 1.6.

Description.—(From a specimen taken at Colorado Springs Dec. 7): Above a rather pale buffy ochraceous, brighter than in *P. montanus*, and heavily lined with black on dorsal area; upper tail stripe dusky, quite blackish toward base; under blackish and dusky, not extending to pencil, and in many specimens it does not extend much more than half-way to the pencil. A decidedly paler animal than *montanus*.

Distribution.—Richardson's Kangaroo Rat is reported from Oklahoma, western Texas, eastern New Mexico, Colorado, north-eastern Utah, and Wyoming. In Colorado it is found all over the plains region of the eastern part of the State, coming westward as far as the foothills, and up the Arkansas River to at least as far as Salida and Poncha Springs, at a little over 7,000 feet elevation. It is also found in northwestern Colorado. It has been taken in Denver, Weld, Jefferson, Adams, Cheyenne, Yuma, El Paso, Pueblo, Prowers, Baca, Chaffee, Routt, and Rio Blanco counties.

Habits.—Half-grown young of this species were taken in Baca County about the first of May, and near Colorado Springs one about three fourths grown was taken the last of November, showing that the breeding season may extend over the summer and fall. A female taken April 20th contained three embryos.

Perodipus longipes (Lat. *longus*, long, + *pes*, foot, long-footed).

Dipodops longipes Merriam, *N. A. Fauna*, No. 3, p. 72 (1890).

Type locality.—Echo Cliffs, Painted Desert, Coconino County, Arizona.

Measurements.—Total length, 10.8; tail vert., 6.5; hind foot, 1.65.

Description.—(From a specimen taken in western Montezuma Co. April 12): Above bright ochraceous buff, finely but rather sparsely interlined with black-tipped hairs. Upper and lower tail stripes dusky, continuous with pencil. Under parts pure white. Specimens of Kangaroo Rats taken at Coventry and Bedrock, southwestern Montrose County, while different in color from the typical animal, are not regarded by Dr. Merriam as sufficiently so for separation. Instead of being a bright, clear buff, they are dusky, and more or less lined with black. It is a similar color phase to that mentioned in the cases of the Golden Pocket Gopher and Apache Pocket Mouse from the same locality.

Distribution.—The Moki Kangaroo Rat inhabits Arizona, New Mexico, southeastern Utah, and southwestern Colorado. In Colorado it has been taken in the western parts of Montezuma, Montrose, and Mesa counties. At Coventry, Montrose County, it reaches an elevation of 6,800 feet.

Family GEOMYIDÆ

Rodents of fossorial habits with stout thickset bodies, short stout limbs, short tails, and small eyes and ears, and provided with large fur-lined cheek pouches opening on either side the blunt head outside the mouth; skull with strong flaring zygomatica; dentition, i., $\frac{1}{1}$; c., $\frac{0}{0}$; pm., $\frac{1}{1}$; m., $\frac{3}{3} \times 2 = 20$; incisors broad; molars rootless, with transverse laminae.

This family is confined to North America, south to Panama.

KEY OF THE GENERA

- A. Upper incisors without grooves, quite smooth. **Thomomys**, p. 77.
- B. Upper incisors with two longitudinal grooves. **Geomys**, p. 85.
- C. Upper incisors with one longitudinal groove. **Cratogeomys**, p. 89.

Genus THOMOMYS (Grk. *thomos*, a heap, + *mus*, mouse, in allusion to the mounds thrown up by the animal).

Thomomys Wied, *Nova. Acta. Acad. Cæs. Leop. Carol.*, xix., pt. 1, p. 377 (1839). Type *T. rufescens*.

Pocket Gophers which, though closely resembling the two following genera externally, are easily distinguished from them by their upper incisors which are smooth and without the median sulcus or groove, though there is a very fine one along the inner side of the tooth; enamel plates completely surround the premolar and molars of the upper jaw; the external edges of the crowns of the upper molars and the internal edges of the lower molars are drawn out into somewhat acute angles.

This genus contains some 50 described species and has a more westerly and more extensive range than the two following, extending from about Lat. 55° in Alberta southwards through the western half of the United States and the high plateau of Mexico to about the latitude of Mexico City.

Examples of seven species and subspecies have been taken within the limits of the State of Colorado.

KEY TO THE SPECIES OF THOMOMYS

- A. Larger. Adults usually over 9 ins. total length.
 - a. In fresh pelage, a bright red golden-brown color above. *T. aureus*, a, p. 79.
 - b. Dusky brown above, blackish looking on back. *T. aureus*, b¹, p. 79.
 - c. Color above *chestnut*, with rufous tinge, not golden, or else dull fulvous, with grayish tinge. *T. a. pervagus*, p. 79.
- B. Smaller. Adults usually under 9 ins. total length.
 - a. Chin black.
 - a'. Larger, length 8.75; cheek pouches white inside. *T. fulvus*, p. 80.
 - b'. Smaller, length 7.8; cheek pouches dusky inside. *T. c. ocius*, p. 81.
 - b. Chin white.
 - a'. Whitish below, pale drab above. *T. t. agrestis*, p. 84.
 - b'. Fulvous below.
 - a''. Color dark, chestnut or chocolate, lower lips blackish. *T. fossor*, p. 82.
 - b''. Color paler, more of a buffy brown. *T. clusius*, p. 80.

¹ This applies to specimens from southwestern Montrose County; some Montezuma County specimens also show this variation in color.

Thomomys aureus (Lat., golden). Golden Pocket Gopher

Thomomys aureus, Allen, *Bull. Am. Mus. N. H.*, v., p. 249 (1893).

Type locality.—Bluff City, San Juan Co., Utah (C. P. Rowley).

Measurements.—Total length, 9.7; tail vert., 2.5; hind foot, 1.35.

Description.—(From a specimen taken in western Montezuma County April 13th): Above a bright light golden brown; a little blackish on face; feet and under parts whitish gray, tinged a little with buffy. Tail buffy above, paler below. There is considerable individual variation in color, and some specimens are much darker than this.

This species has proportionately the largest and most massive skull of all the Colorado *Thomomys*; the zygomatic arch is wide-spreading and squarish with flattened and flaring malar; the brain case wide posteriorly, and the interorbital constriction considerable. The nasals do not extend as far back as the ends of the maxillæ.

Specimens from southwestern Montrose County (Coventry and Bedrock) are dusky brown above, with blackish appearance on back; muzzle and chin blackish, under parts pale fulvous. A rather differently colored animal from typical *aureus*, but skulls identical.

The variation in color described in Montrose County specimens is similar to that noted in the case of the Moki Kangaroo Rat and the Apache Pocket Mouse. It is a darkening and dulling of the color of the upper parts, possibly having some connection with the color of the soil, which in this region is a reddish color, evidently due to iron oxide. It is a curious fact that this has apparently affected these three species only, and that they all are burrowing animals having external cheek pouches.

Distribution.—The Golden Pocket Gopher has been reported from Utah and Colorado, and no doubt occurs in the adjoining parts of New Mexico and Arizona. In Colorado it has been taken in La Plata, Montezuma, Montrose, and Mesa counties, up to about 7,000 feet altitude, or perhaps somewhat higher, where it would begin to overlap the range of *Thomomys fessor*.

Habits.—Nursing females and half-grown young have been taken in April, and in the same month a specimen was taken containing four embryos.

Thomomys aureus pervagus (Lat. *per*, through, + *vagus*, wandering). Roaming Pocket Gopher.

Thomomys aureus pervagus Merriam, *Proc. Biol. Soc. Wash.*, xiv., p. 110 (1901).

Type locality.—Espanola, Santa Fé County, New Mexico (J. A. Loring).

Measurements.—(Merriam): Total length, 9.6; tail vert., 2.9; hind foot, 1.25.

Description.—(From a specimen taken at Antonito, Conejos Co., Colo., Aug. 30th): Above, chestnut brown, not golden as in *aureus* and much darker. (Specimens from Salida are mostly a dull fulvous above, with a grayish tinge.) Feet and under parts grayish, darker than *aureus*, and tinged with buffy. Tail buffy. More blackish about face than *aureus*.

Distribution.—This subspecies is reported from New Mexico and Colorado. In Colorado it has been recorded from Antonito and from the Conejos River, both in Conejos County; the altitude of Antonito is a little over 8,000 feet; specimens from Salida are also considered by Dr. Merriam as being typical *pervagus*.

Thomomys fulvus (Lat., tawney). Fulvous Pocket Gopher.

Geomys fulvus Woodhouse, *Proc. Acad. Nat. Sci. Phila.*, p. 201 (1852).

Type locality.—San Francisco Mountains, Arizona.

Measurements.—Total length, 8.8; tail vert., 3.0; hind foot, 1.2.

Description.—(From a specimen taken near Glenwood, N. M., Nov. 1, 1906): Above dark fulvous, some black hairs showing; sides brighter; under parts bright clear fulvous; chin black; cheek pouches lined with white; tail dark fulvous; feet whitish gray.

Skull of medium length, broad across zygomata, but rather narrow interorbitally; malars only moderately flaring; brain case not markedly triangular.

Distribution.—The Fulvous Pocket Gopher has been taken in Arizona, New Mexico, western Texas, Colorado, and Chihuahua, Mexico. In Colorado it is recorded from Fisher's Peak, Las Animas County, collected by A. H. Howell, and recorded by Cary.

Thomomys clusius (Lat. *clausus*, shut). Plains Pocket Gopher.¹

Thomomys clusius Coues, *Proc. Acad. Nat. Sci. Phila.*, 1875, p. 138.

¹ *Thomomys clusius fuscus*, Fuscous Pocket Gopher. There are some specimens of *Thomomys* from Nederland, Boulder County, in the Field Columbian Museum labelled *fuscus*. I have examined these and they seem to be identical with specimens of *T. fossor* from various other parts of Colorado.

Type locality.—Bridger's Pass, Wyoming.

Measurements.—Total length, 8.0; tail vert., 2.5; hind foot, 1.05.

Description.—(From a specimen taken at Colorado Springs, Oct. 11th): Above, brown, somewhat grayish, and a few black-tipped hairs intermingled; sides more ochraceous; feet whitish gray; under parts buffy white or pale fulvous; a little blackish on face; chin white; tail gray.

The skull of this species is rather light and thin; the interorbital constriction considerable; the posterior curve of the zygomata quite square. The incisors are small compared with those of *T. fulvus*. Auditory bullæ of medium size. The nasals extend as far back as the maxillæ.

Distribution.—The Plains Pocket Gopher is reported from Wyoming, Utah, Colorado, and Idaho. In Colorado it has been recorded from El Paso and Larimer counties, and is apparently found along the base of the foothills, and does not go very far out onto the plains. At Colorado Springs it overlaps the range of *Geomys lutescens*.

Thomomys clusius ocus (Lat. *ocus*, swift). Swift Pocket Gopher.

Thomomys clusius ocus Merriam, *Proc. Biol. Soc. Wash.*, xiv., p. 114 (1901).

Type locality.—Fort Bridger, Uinta County, Wyoming.

Measurements.—(From Merriam *l. c.*): Total length, 7.75; tail vert., 2.25; hind foot, 1.0.

Description.—According to Merriam this subspecies is paler than *T. clusius* and the upper parts are pale buffy; sides of nose and region around mouth dusky plumbeous; cheeks pale buffy gray; sides whitish, tinged with buffy; feet and under parts white. This is from the type. A specimen taken near Craig, Routt County, June 14th, is actually somewhat darker than the above described specimen of *T. clusius*, and the color rather inclined to chestnut; the under parts are buffy ochraceous. The only strong point of difference is the blackish on face and chin.

The skull is like that of *T. clusius* but the zygomata are less spreading; and bullæ decidedly larger.

Distribution.—This subspecies has been found in Colorado and Wyoming. In Colorado it has been taken only in Routt County, from Craig westward, and was reported by both Cary and Warren. It is found at least as far south as the Bear River as specimens were taken there south of Lay, and also at Lily, which is on the Bear. Cary thinks "the high escarpment of the Book Plateau probably

forms the southern boundary of the dispersion of this species." It probably ranges up to about 7,000 feet elevation.



FIG. 29. FACE OF MOUNTAIN POCKET GOPHER, *Thomomys fessor*
Showing openings of cheek pouches. E. R. Warren, Photo.

Habits.—Half-grown young were taken at Craig about the thirteenth of June.

Thomomys fessor (Lat. *fossus*, pp. of *fodere*, to dig).
Mountain Pocket Gopher.

Thomomys fessor Allen, *Bull. Am. Mus. N. H.*, v., p. 51 (1893).

Type locality.—Florida, La Plata County, Colo., 7,200 ft. (C. P. Rowley).

Measurements.—Total length, 8.25; tail vert., 2.25; hind foot, 1.15.

Description.—(From a specimen taken near McCoy, Eagle

County, May 23d): Color, above a dark reddish brown, almost chestnut; brightest on sides; nose and sides of mouth blackish; chin white; feet grayish white; under parts buffy ochraceous; tail blackish, often with whitish tip. This species is the darkest of the Colorado Pocket Gophers, though somewhat variable in color. Sometimes it inclines strongly toward chocolate. Several specimens in the Warren collection show white hairs scattered here and there on the upper parts; in some cases enough to make irregular spots. Skins from different localities show this. It does not seem to be a phase of albinism, as several partial albinos of other species in the same collection show the white in distinct patches and blotches.

The skull is somewhat larger than that of *T. clusius*, with somewhat wider spreading zygomata, and less interorbital constriction; bullæ a trifle larger than in *T. clusius*; nasals do not extend as far back as the maxillæ.

Distribution.—The Mountain Pocket Gopher has thus far only been found in Colorado, where it is recorded from La Plata, Gunnison, Garfield, Rio Blanco, Routt, Larimer, Eagle, Chaffee, Saguache,



FIG. 30. MOUNTAIN POCKET GOPHER, *Thomomys fessor*

E. R. Warren, Photo.

Huerfano, Custer, El Paso, and Teller counties. It keeps to the higher elevations as a rule, and no doubt is found in all our mountain countries. It sometimes ranges as low as about 6,000 feet but

is generally at higher elevations up to timber-line or higher, for its workings may be seen on the grassy slopes at those high altitudes.

Habits.—A female taken at Mud Springs, Garfield County, 8,850 feet, July 13th, contained three small embryos; one taken at Garretson's Ranch, Muddy Creek, Huerfano County, 8,300 feet, July 14th, contained four embryos.

Thomomys talpoides agrestis (Lat. *talpa*, a mole; Lat. *agrestis*, pertaining to the fields). San Luis Pocket Gopher.

Thomomys talpoides agrestis Merriam, *Proc. Biol. Soc. Wash.*, xxi., p. 144 (1908).

Type locality.—Medano Ranch, San Luis Valley, Costilla County, Colorado.

Measurements.—(From Merriam *l. c.*): Total length, 8.35; tail vert., 2.15; hind foot, 1.15.

Description.—(From a specimen from type locality, taken Oct. 26th): Above drab, with pale ochraceous cast, especially marked on top of head; ear spots conspicuously dusky; under parts whitish; chin white; lining of cheek pouches apparently ochraceous; tail and feet pale gray.

Skull proportionately rather large; zygomatic breadth moderate; interorbital breadth rather narrow; brain case triangular; bullæ rather large; nasals much narrower posteriorly.

Distribution.—In travelling through the San Luis Valley by wagon recently I first noted gopher workings a few miles north of Moffat, Saguache County, and took one at that place; workings were seen occasionally near the road as far south as Mosca; I went no farther south than that place; workings were seen near the San Luis Lakes, and the species was common in the meadows at the Medano Ranch, the type locality. One was taken at Mosca Creek, at the mouth of the gulch leading up to Mosca Pass. The exact limits of its range are as yet unknown. It has since been taken at Crestone, Saguache County.

Habits.—The general habits of the San Luis Gopher do not seem to differ from those of other species. One taken at Medano Ranch July 2d contained apparently four large, and two small embryos. Its mammae were two inguinal and five abdominal.

Genus GEOMYS (Grk. *ge*, the earth + *mus*, mouse)

Geomys Rafinesque, *Am. Month. Mag.*, ii., No. 1, p. 45 (1817).
Type *G. tuza*.

Revision, Merriam, *N. A. Fauna*, No. 8 (1895).

Pocket Gophers with the common external features of the family; dentition: i., $\frac{1}{1}$; pm., $\frac{1}{1}$; m., $\frac{3}{3} \times 2 = 20$; the upper incisors broad and strongly bisulcate, with a principal sulcus or groove slightly to the outer side of the median line and a small inner groove close to the inner edge of each tooth; upper premolar without posterior enamel plate; anterior and middle upper molars with posterior enamel plates complete.

The species of this genus are spread over the central portion of the United States from Minnesota to the Mexican boundary and from east of the Rocky Mountains to the Mississippi, together with the southern half of Alabama and Georgia and the northern half of Florida.

Nine species are recognized by Elliot in his Check-list and only one of these has been found within the limits of Colorado.

Geomys lutescens (Lat. *lutescere*, to turn to mud, suggesting clay color). Yellow Pocket Gopher.

Geomys bursarius lutescens Merriam, *N. A. Fauna*, No. 4, p. 51 (1890).

Type locality.—Sandhills on Birdwood Creek, Lincoln Co., Nebraska (A. B. Baker, 1889).

Measurements.—Total length, 9.6; tail vert., 2.75; hind foot, 1.25.

Description.—(From a specimen taken at Colorado Springs, Oct. 19th): Upper parts pale fulvous; upper surface of feet whitish; under parts whitish, with buffy cast. Basal half of tail above like back, end blackish; whitish below.

Distribution.—The Yellow Pocket Gopher is found in southwestern South Dakota, western Nebraska and Kansas, eastern Wyoming and Colorado, western Oklahoma and Texas, ranging about as far east as the 99th meridian. In Colorado it has been recorded from Larimer, Weld, Boulder, Denver, Jefferson, Adams, Yuma, Cheyenne, El Paso, Prowers, and Baca counties. The Arkansas River is apparently the south boundary of its range, except in Prowers County and the extreme eastern part of Baca

County, where it is found down toward the southeast corner of the State. It does not apparently range above 6,000 feet elevation.

Habits.—All the species of Pocket Gophers are so alike in their general habits that the following description will suffice for all. They are animals whose lives are spent underground in the burrows and tunnels which they are perpetually digging. The presence of the animals in any place is shown by the mounds of earth which are thrown up from the workings by the gopher. The holes are excavated by means of the powerful front feet, which are especially fitted for digging, with their long curved claws; they are also said to use the strong upper front teeth as a pick to loosen the earth in the front of the tunnel. When the earth has been loosened it is pushed toward the opening by the animal bringing its wrists together under the chin, with the palms held vertically, and then forcing itself along by its hind feet, and pushing the earth to the opening and out to the surface. The animals are either unable to push the whole load out at once or else they gather an accumulation close to the hole, for if one watches a gopher pushing the earth out of a burrow he will see a little pile of dirt come out, catch just a glimpse of the creature's head, perhaps, which immediately disappears, and very quickly another load is pushed out. After this performance has been repeated several times there is a considerable interval when nothing is done on the surface, and then it begins over again. It is very possible that a gopher can force more of a load along the tunnel in front of itself than it can push upward through a smaller opening, as these external ones usually are, and also frequently off to one side the main tunnel. The size of the workings varies of course with that of the species which make them. The earth which is thus thrown out forms mounds of varying size on the surface and by them the general course of the tunnels can be traced. Sometimes they are a considerable distance apart, and again

the same individual may throw up a series of small mounds very close together; as a rule when they are some distance apart they are of considerable size.

A gopher which was kept in confinement for some little time by Dr. Merriam ran backward as easily as forward, and seemed to use the tail as an organ of touch when running backward. The tail is large and fleshy, and this seems to be its function.

Gopher burrows may be said to be endless—they begin nowhere and never end until the owner dies. He is always working at them, and never seems to have any plan of work; a layer of soft ground may induce him to dig through it, then a stone causes a turn, a tender root of some kind starts it off after that. Perhaps the creature is working in somebody's garden, and there is a melon that the animal has taken a fancy to; the tunnel is carried under the melon, an opening made up to the surface, and the whole interior of the fruit can be eaten without giving any external evidence that anything is wrong. The gopher often has two or more headings which it is working on at the same time, now digging a little at one and again at another, and there seems to be no part of its open workings which it will not traverse sometime every two or three days at least. While the portions of the workings that are in use are always kept open and practically free from dirt, those which have been abandoned are generally filled up with earth packed tight; this packing usually begins at the surface opening through which the animal has been throwing out earth, and extends back from that often for quite a little distance. The main tunnel is usually from six inches to a foot below the surface but may at times be deeper, in the case of hard or frozen ground. In uncultivated ground the gophers may do much good by turning over the soil and burying weeds and other plants under their mounds. This vegetable matter decays

and enriches the soil, when it might otherwise have been lost.

Gophers do not hibernate but they are active all the winter; where the ground is frozen they work below the frost line but probably not as actively as during other seasons; where the snow lies deep, as it does in our mountain districts, the earth is brought to the surface as usual and pushed out under the snow in long cylinders, which may be seen there after the snow has melted in the spring. They store a certain amount of food in the fall but to just what extent they are dependent on it for winter use is not known. Their food consists of roots, tubers, and other hard vegetable substances, and they will also eat grass and leaves of some kinds. They may be very injurious at times about farms, eating and destroying many potatoes and other root crops, and also damaging fruit and other trees by tunnelling about the roots and eating the bark; they are known to work all around a tree and to eat the bark off all around every root, and thus kill the tree. The cheek pouches are used for conveying the food to the store-rooms in the tunnel but never for carrying out earth from their excavations, though many people suppose that this is the case. The food is put into the pouches by means of the fore paws and is emptied out in rather a curious manner. Dr. Merriam describes the process, and I can confirm it by my own observations:

"The fore feet are brought back simultaneously along the sides of the head until they reach a point opposite the hinder end of the pouches; they are then pressed firmly against the head and carried rapidly forward. In this way the contents of the pouches are promptly dumped out in front of the animal. Sometimes several strokes are necessary."

Not very much is known about the breeding habits of Pocket Gophers; they breed in spring and early summer, and in most cases at least have but small litters of young, two

or three each, though Stephens mentions one case of a California species of *Thomomys* where he found six embryos in a female. Such special cases as have come to my notice are mentioned under the species they belong to.

Gophers are of solitary habits and almost invariably but one will be found in a burrow, except during the breeding season, when a pair may be together. The young start out to shift for themselves at an early age and dig their own tunnels. The animals seem to be of a naturally vicious disposition; when caught in traps they fight fiercely, trying to bite their captor. Their large strong front teeth make them rather formidable as they could inflict severe wounds with them if given a chance; but I have always been particular not to let them have the chance. This savage disposition is what we might expect from their solitary habits. They do not seem to have any cries worthy of mention; the only noise I have heard them make is a faint squeaking when one was alive in the pocket of a shooting coat and trying to make its escape; this note was so faint as to be scarcely audible, but was something like the squeak of a mouse. I have heard it several times.

An excellent account of the habits of Pocket Gophers, as well as of their anatomy and classification may be found in Dr. C. Hart Merriam's paper "Monographic Revision of the Pocket Gophers," *North American Fauna*, No. 8, published by the U. S. Department of Agriculture, and also in Bulletin No. 5 of the Biological Survey, "The Pocket Gophers of the United States," by Vernon Bailey. This latter is a more popular account of the animals and gives directions for destroying them, as well as much about their habits.

Genus CRATOGEOMYS (Grk. *kratos*, strong, powerful, and *geomys*).

Cratogeomys Merriam, *N. A. Fauna*, No. 8, p. 150 (1895). Type *C. merriami*.

Revision, Merriam, *N. A. Fauna*, No. 8 (1895).

Resembling *Geomys* in external characters, but at once distinguished by the upper incisors, which have only one longitudinal groove instead of two; upper premolar with no enamel on its posterior face as is also the case with the first and second upper molars; posterior upper molar with a sulcus on its outer face, dividing it into two imperfect prisms. Skull large and massive.

This genus inhabits the Great Plains of the United States, from southern Colorado extending southward through the eastern tableland of Mexico to the States of Mexico and Pueblo.

Eight species were recognized by Merriam in his revision, all of which are confined to Mexico, except one here described, which forms part of the Colorado fauna.

Cratogeomys castanops (Grk. *kastanos*, the chestnut tree, + *opsis*, appearance).

Pseudostoma castanops Baird, *Report, Stansbury's Exp. to Great Salt Lake*, p. 313 (1852).

Type locality.—"Prairie Road to Bent's Fort," near Las Animas, Bent Co., Colorado.

Measurements.—Total length, 10.5; tail vert., 2.6; hind foot, 1.5.

Description.—(From a specimen taken at Springfield, Baca Co., Colo., April 12th): Above yellowish brown, with black-tipped hairs intermixed; feet grayish; under parts buffy; tail like back, except tip which is blackish. A darker colored, larger, heavier built, and bulkier animal than *G. lutescens*.

The skull is proportionately much larger and more massive than in *G. lutescens*, with strong, widely spreading zygomatics, and very large incisors.

Distribution.—The Chestnut-faced Pocket Gopher is reported from southeastern Colorado, eastern New Mexico, western Oklahoma, western Texas, and the States of Coahuila and Chihuahua, Mexico. Its range in Colorado is practically confined to the region south of the Arkansas River, although it has been taken a few miles to the north, near Lamar. It is recorded from Bent, Prowers, Las Animas, Pueblo, and Baca counties, and no doubt is found also in Otero County. It has been taken as far west as the city of Pueblo.

Habits.—Because of its larger size this species is possibly

more injurious to man than either of our others, as the mounds of earth thrown up by it are much larger than those of any of the other gophers, and it naturally requires more

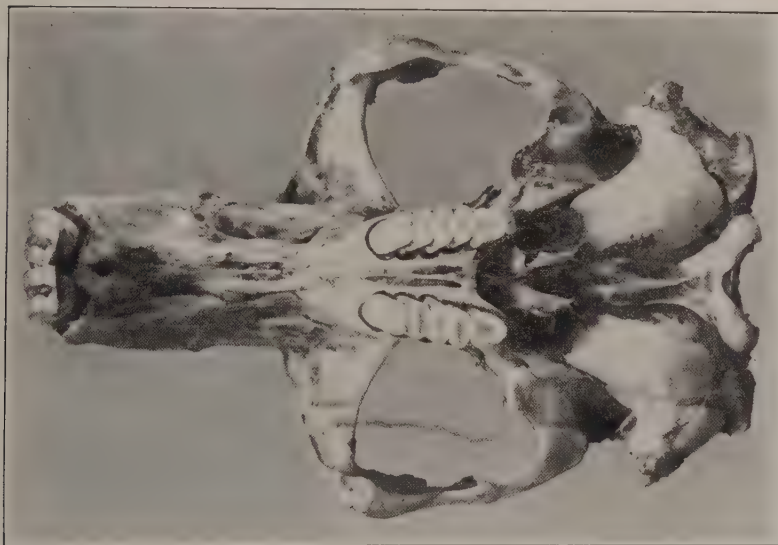


FIG. 31. CHESTNUT-FACED POCKET GOPHER, *Cratogeomys castanops*
Skull showing dentition $\times 1\frac{3}{4}$

food. A female, taken in Baca County May 21st, contained three embryos, but half-grown young had been taken a month earlier than that, and also nursing females.

Family MURIDÆ

Animals mostly of terrestrial habits, and usually of small or moderate size, with naked and scaly or but scantily haired tails and a rudimentary pollex; skull without postorbital processes and with contracted frontals; the anterior portion of the zygomatic arch is usually flattened into a perpendicular plate so that the infraorbital foramen forms a somewhat T-shaped opening when viewed from above;

dentition (in all Colorado forms): i. $\frac{1}{1}$; c. $\frac{0}{0}$; pm. $\frac{0}{0}$; m. $\frac{3}{3} \times 2 = 16$; lower incisors compressed; no premolars; molars rooted or rootless, tuberculate or with angular enamel folds.

This is a cosmopolitan family with a very large number of genera and species, including more than a third of all existing rodents.

KEY OF THE SUBFAMILIES AND GENERA

- A. Molars rootless or imperfectly rooted, composed of longitudinal rows of triangular prisms. (*Microtinæ*.)
 - a. Animals of small size, under 10 ins. total length; tail short and less than half the length of the body, and rounded.
 - a'. Angles on the outer and inner sides of the lower molars approximately equal.
 - a''. Color of back never rufescent; molars quite rootless, *Microtus*, p. 93.
 - b''. Color of back always rufescent; molars quite rootless. *Evotomys*, p. 101.
 - b'. Molars with two roots in adults; angles on the outer side of the lower molars far deeper than those on the inner. *Phenacomys*, p. 103.
 - b. Large animals, total length about 20 ins.; tail laterally compressed and flattened and fringed with stiff hairs. *Fiber*, p. 105.
- B. Molars rooted but not tuberculate, with folded enamel plates resembling those of *Microtinæ*. (*Neotominæ*.)

Animals of large size over 10 ins. total length with long tails, sometimes bushy, sometimes only thickly haired. *Neotoma*, p. 108.

- C. Upper molars with tubercles arranged in two longitudinal rows. (*Cricetinæ*.)
 - a. Incisors grooved; tail more than half the length of the body. *Reithrodontomys*, p. 121
 - b. Incisors smooth, without grooves.
 - a'. Tail less than $\frac{1}{2}$ length of body; sole hairy on posterior half, with only four small anterior pads. *Onychomys*, p. 124
 - b'. Tail more than $\frac{1}{2}$ length of body; sole naked, with the usual six pads. *Peromyscus*, p. 127
- D. Upper molars with tubercles arranged in three longitudinal rows. (*Murinæ*.)

- a. Tail about as long as the body, naked and scaly; ears naked.

Mus, p. 137

Subfamily MICROTINÆ

The members of this family are externally distinguished as a rule by their clumsy heavy build, their small eyes, blunt muzzles, small ears, and shorter limbs and tails; skull short and broad, nasals short, hardly extending beyond the pre-maxillæ; swelling of the root of the lower incisors chiefly on the inside of the mandible; molars rootless or imperfectly rooted, composed of longitudinal rows of triangular prisms placed alternately.

This subfamily containing the Voles is confined to the Palearctic and Nearctic regions (*i.e.*, the northern portions of the Old and New Worlds).

Genus MICROTUS (Grk. *mikros*, small, + *otus*, ear, small-eared).

Microtus Schrank, *Fauna Boica.*, i., pt. 1, p. 72 (1798). Type *M. arvalis*.

Revision, Bailey N. A. *Fauna*, No. 17 (1900).

Small voles with rounded tails as long as and usually longer than the hind feet; first digit of the fore feet with a small rudimentary pointed claw with a flat nail. Dentition, i. $\frac{1}{2}$; m. $\frac{1}{2} \times 2 = 16$; lower incisors with the roots extending far behind and on the outer side of the molars; upper incisors not grooved; molars rootless, the outer and inner reëntrant angles approximately equal.

The members of this large genus are to be found all over the temperate portions of Europe, Asia, and North America, ranging north to the extreme limit of mammalian life and south to the edge of the tropics. According to Elliot's Checklist some 53 species are found in North America, distributed among nine subgenera. Hitherto only five species have been found within the limits of Colorado, representing three subgenera; these can be distinguished as follows:

KEY OF THE SPECIES

- A. Mammæ 8; plantar tubercles 6; 3d upper molar with 3 closed triangles; 1st lower molar with 5 closed triangles.
(Subgenus **Microtus**.)
- a. Larger, total length over 6.25.
a'. Color above darker; tail short, about 25% of total length.
M. penn. modestus, p. 95.
- b'. Color above grizzled grayish brown, sides grayish, tail longer, about 36% total length. **M. mordax**, p. 99.
- b. Smaller, total length usually under 6. Color above grizzled grayish brown; tail short, about 25% total length.
M. nanus, p. 98.
- B. Mammæ 8; plantar tubercles 5; 3d upper molar with 2 closed triangles and narrow posterior loop; 1st lower molar with 5 closed triangles.
(Subgenus **Lagurus**.)
- a. Size small, tail very short, less than $\frac{1}{2}$ total length.
M. pauperrimus, p. 100.

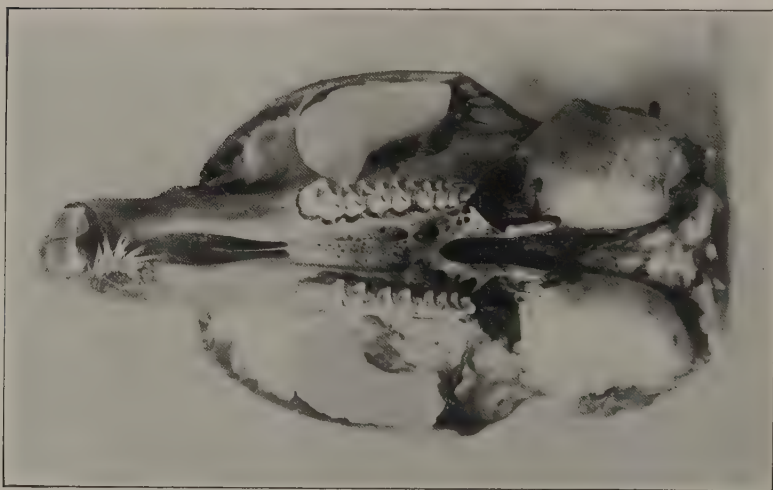


FIG. 32. SAGUACHE VOLE, *Microtus p. modestus*
Skull showing dentition x 3

- C. Mammæ 6; plantar tubercles 5; 3d upper molar with only 2 closed triangles; 1st lower molar with 3 closed triangles.
(Subgenus **Pedomys**.) **M. haydeni**, p. 101.

Many of the meadow voles resemble one another so very

closely in external appearance that it is often quite impossible to distinguish them by external characters, and an examination of the molar pattern is frequently necessary for their determination.

***Microtus pennsylvanicus modestus* (Lat., modest).**

Saguache Meadow Vole.

Arvicola modesta Baird, *N. Amer. Mamm.*, p. 535 (1857).

Type locality.—Cochetopa Pass, Saguache Co., Colorado.

Measurements.—Total length, 6.9; tail vert., 1.8; hind feet, 0.8.

Description.—(From a specimen taken at Colorado Springs, March 9th): Above a dark grizzled brown, somewhat ochraceous; feet plumbeous; under parts a whitish gray; tail bicolor, blackish above, grayish below. In summer pelage lighter and more ochraceous.

Distribution.—Bailey gives the distribution of this species as "Rocky Mountains and western plains from New Mexico to British Columbia and from the Black Hills of South Dakota to central Idaho and beyond, with slight variation, to the plains of the Columbia, mainly in Transition Zone." It has been reported from Colorado, Wyoming, South Dakota, North Dakota, Montana, Idaho, Washington, and Utah. In Colorado it has been recorded from Saguache, Costilla, Custer, Chaffee, Lake, Teller, El Paso, Adams, Yuma, Jefferson, Larimer, and Boulder counties, reaching at times an elevation of a trifle above 9,000 feet.

Habits.—Some of the habits of voles, or field-mice of the genus *Microtus* are common to practically all the species. They live in underground burrows and have many little well-beaten roads or trails running from one burrow to another. In the burrows are placed the nests of soft grass or plant fibre, and nests are also made on the surface amongst the thick grass, weeds, or other vegetation. The nest is globular in form, with a chamber in the centre, and entrance through one or more holes on the side.

They breed most of, if not all, the year round, and have from four to eight young at a birth. They thus increase with great rapidity in spite of their numerous enemies, which

are owls, hawks, weasels, minks, foxes, coyotes, cats, badgers, skunks, and other animals, as well as snakes.

Their food is mainly vegetable, though they never refuse meat, and will eat their own species when caught in traps. The vegetable food consists of the tender portions of grass, seeds, and grain, and in winter they gnaw the bark from the roots and trunks of trees and shrubs.

Because of their abundance and prolificacy the voles are of considerable economic importance, and at times do much damage to crops and trees. In Europe and Asia invasions of armies of these creatures have been reported, the animals moving in large numbers across the country, devouring much of the field and garden crops which come in their way. No such invasions have yet occurred in North America, but in the Humboldt Valley, Nevada, in 1907, one species was so abundant that their numbers were estimated to be 12,000 to the acre in some of the alfalfa fields, and were doing great damage.

In this country much harm may be done by the normal number of voles present in a field or meadow. It has been calculated that the amount of green vegetation eaten by an adult in the course of a year is from 24 to 36 pounds, so that the large numbers of them often present in a field can consume much grass and cause considerable loss to the farmer, for they not only eat the grass but they leave much of it lying on the ground, having eaten only the tenderest part. In winter they burrow into the haystacks in the field and do much damage there. In grain fields the harm begins as soon as the grain begins to sprout, for the tender shoots are cut down and eaten; when the grain is ripe or nearly so the stalks are cut down to get at the grain itself, and when it is harvested the shocks and stacks are attacked and the grain in them eaten. Voles can also do much harm in gardens of any kind by attacking the young growing plants

It is because of the damage they do at times to nursery and orchard stock that voles have come into considerable prominence of late years in this country. While the worst damage is done in severe winters with deep snows, yet harm has been done in mild winters, and even during the summer season they occasionally attack trees, showing that it is a matter of choice as well as necessity. Perhaps one reason that so much notice is taken of the damage inflicted in this manner is because it is something much more easily figured in dollars and cents than that done in the fields. In the winter of 1901-2 it was estimated that the damage sustained by the nurserymen in the vicinity of Rochester, N. Y., was \$100,000. During the winter of 1903-4 meadow-mice destroyed thousands of trees and shrubs of all kinds in the Arnold Arboretum, Jamaica Plain, Mass. This was a most exceptionally severe winter in that portion of the country. Lantz, in an examination of an orchard near Washington, D. C., containing 380 apple trees, found that 43 per cent. were completely girdled and ruined, 10 per cent. were less badly injured, and 47 per cent. were apparently unharmed. This was one winter's work for the pests. In an orchard in Kansas, examined by the same observer, 5,000 out of 26,000 trees had been more or less completely girdled before December 18th. This orchard had been neglected and weeds allowed to grow rankly in it, and amongst these weeds the mice had found most congenial homes and breeding places, and had increased greatly in numbers.

Much information regarding this matter will be found in *An Economic Study of Field Mice*, by David E. Lantz, published as *Biological Survey Bulletin No. 31*, by the U. S. Department of Agriculture. The species which does very much of the damage is *Microtus pennsylvanicus* and its various subspecies of which *modestus* is one.

One reason for the increase in numbers of these animals is

no doubt the foolish destruction of their natural enemies, especially hawks and owls, which almost every farmer thinks it a sacred duty to kill at every opportunity, and too many so-called sportsmen shoot merely to see them drop. Many of these birds are worth more to a farmer for the mice they destroy than the price of several chickens to save whose lives the birds are killed. As a matter of fact most of our hawks and owls trouble poultry but little.

The Saguache Vole prefers to live about damp and marshy places, and wet meadows, and in these places its runways can often be found in great abundance, and the animal running about in them, for the voles are abroad much of the daytime.

Microtus nanus (Grk. *nanos*, a dwarf). Dwarf Vole

Arvicola nanus Merriam, *N. A. Fauna*, No. 5, p. 63 (1891).

Type locality.—Pashimeroi Mts., Idaho, 9,350 ft. (Merriam and Bailey).

Measurements.—Total length, 5.6; tail vert., 1.55; hind foot, 0.75.

Description.—(From a specimen taken at Crested Butte, Oct. 16th): Upper parts a grizzled grayish brown, but lighter than preceding species, fewer black hairs intermixed; feet grayish; under parts a whitish gray; tail bicolor, gray above, not *blackish*, lighter below.

Distribution.—The Dwarf Vole is reported from Idaho, Utah, Wyoming, Montana, and Colorado. In Colorado it has been recorded from Larimer, Boulder, Grand, Routt, Gunnison, Lake, and Montrose counties. It is mainly an inhabitant of the Canadian Zone, and is therefore confined to the mountains. It will no doubt eventually be recorded from all the mountain counties. The lowest elevation at which I know of its being taken is 7,000 feet, near Coventry, Montrose County, and it has been taken up to nearly 11,000.

Habits.—This species seems to prefer dryer ground to the Saguache Vole, and is found much on the grassy hillsides; at the same time it is also found in the meadows. It makes runways and nests, and its general habits are much as described for that species.

Microtus mordax (Lat. *mordax*, biting). Cantankerous Vole.

Arvicola mordax, *N. A. Fauna*, No. 5, p. 61 (1891).

Type locality.—Sawtooth Lake, on the eastern base of Sawtooth Mt., Idaho, 7,200 feet (Merriam and Bailey).

Measurements.—Total length, 7.15; tail vert., 2.6; hind foot, 0.9.

Description.—(From a specimen taken at Crested Butte, Oct. 17th): Above grizzled grayish brown, somewhat lighter than in *M. modestus* and darker than in *M. nanus*, but the sides are distinctly gray; feet gray; under parts whitish gray, somewhat lighter than in *M. modestus* or *M. nanus*; tail bicolor, similar to back above, grayish below. Easily distinguished from *M. modestus* by longer tail, and from *M. nanus* by long tail and larger size.

Distribution.—The Cantankerous Vole has a very extensive distribution, from 60° North Latitude south to New Mexico, and with wide longitudinal range. It is recorded from Circle City, White Pass, and Skagway, Alaska; British Columbia, Alberta, Northwest



FIG. 33. CANTANKEROUS VOLE, *Microtus mordax*
About $\frac{2}{3}$ life size—E. R. Warren, Photo.

Territory, Idaho, Montana, Wyoming, Washington, Oregon, California, Nevada, Colorado, and New Mexico. In Colorado it has

been taken in Larimer, Boulder, Grand, El Paso, Teller, Fremont, Costilla, Hinsdale, San Juan, Mineral, Mesa, Gunnison, Rio Blanco, Saguache, and Montrose counties. It is found most commonly in the Hudsonian and Canadian zones, but ranges well down into the Transition and even Upper Sonoran, having been taken at Grand Junction, 4,600 feet, and from that elevation up to nearly 11,000 feet. While this book has been in press I have seen one from the Summit House on Pike's Peak, 14,147 feet.

Habits.—This vole inhabits quite a variety of ground, as it may be found in wet meadows, on dry grassy slopes, along the banks of the streams, and even about rocks on the hill-sides. Its habits of food and breeding are like those of the other voles. They have been known to come into dwellings which the Dwarf Vole, though equally abundant at the same place, did not seem inclined to do.

I once had one in confinement for some little time, which became quite tame, and allowed itself to be handled freely without attempting to escape. It occasionally made good its name of "cantankerous" by catching hold of one's finger with its teeth and allowing itself to be lifted into the air without loosening its hold. Those little incisors were very nice and sharp and went in good and deep.

Microtus pauperrimus (Lat. *pauper*, poor, in allusion to its small size). Pigmy Vole.

Arvicola pauperrima Cooper, *Am. Nat.* ii., p. 535-536 (1868).

Type locality.—Plains of the Columbia, near Snake River, Washington.

Measurements.—Total length, 4.5; tail vert., 0.75; hind foot 0.36.

Description.—(From specimen taken at Sulphur Springs, April 12th): Above buffy or ochraceous gray, mingled with blackish tipped hairs; ears and nose buffy; feet and under parts gray, lightly tinged with buff. Tail grayish above and buffy below. This species is easily distinguished from all the other species of *Microtus* found in Colorado by its small size and very short tail.

Distribution.—The Pigmy Vole is reported from Washington, Oregon, Idaho, Utah, and Colorado. In Colorado it has been taken only in Larimer, Grand, and Routt counties. It is an inhabitant of the Transition Zone.

Habits.—The Pigmy Vole seems to prefer the dryer prairie lands of the regions it inhabits, and is not found in such wet places as some of the other species. Its general habits seem to be essentially similar.

Microtus ochrogaster haydeni (Grk. *ochros*, yellow, + *gaster*, stomach, *haydeni*, for Dr. F. V. Hayden).

Hayden's Vole.

Arvicola haydeni Baird, *Mamm. N. A.* 543-544 (1857).

Type locality.—Fort Pierre, South Dakota.

Measurements.—Total length 6.5; tail vert., 1.45; hind foot, 0.85.

Description.—(From a specimen taken at Wray, Yuma Co., Mar. 6th): Upper parts grizzled grayish brown, very similar to *M. modestus*; upper surfaces of feet and entire under parts buffy, with plumbeous bases of hairs showing through on belly. Tail buffy above, grayish below. The buffy color of the under parts serves to distinguish it at once from *M. modestus*, the only species which is found in the same range with it in Colorado.

Distribution.—Hayden's Vole is found in the plains region of the following States; South Dakota, Nebraska, Kansas, Colorado, Wyoming, and Montana. In Colorado it is recorded from Larimer, Weld, Fremont, and Yuma counties. It is an inhabitant of the Transition Zone.

Habits.—This species seems to prefer the prairie land as a place of residence. At the same time it may be found in the same locality as the Saguache Vole; at Wray, Yuma County, one of each species was caught at the same time near a spring in traps less than three feet apart.

Genus EVOTOMYS (Grk. *eu*, well, + *ous* (*otis*), ear, well-eared).

Evotomys Coues, *Proc. Acad. Nat. Sci., Phila.*, 1874, p. 186.

Type *E. rutilus*.

Revision, Bailey, *Proc. Biol. Soc. Wash.*, xi., p. 126 (1897).

Small voles with short tails usually from $\frac{1}{4}$ to $\frac{1}{3}$ the total length; eyes small and ears just projecting beyond the fur; back rufescent or reddish brown contrasting with the sides, this coloration is characteristic of all the species; skull with very weak flattened zygomata; dentition, i. $\frac{1}{4}$; m. $\frac{3}{8} \times 2 = 16$; lower incisors with short roots, the latter falling short of the dental foramen; molars

two-rooted in the adult; the outer and inner reëntrant angles at the sides of the lower molars approximately equal in depth.

This is a circumpolar genus being spread over the northern boreal portions of both hemispheres, indeed one species, *E. rutilus*, presents but one phase through this entire region from Scandinavia through Siberia to Arctic America.

Some 20 American species and subspecies of this genus have been described, their range covering the northern half of the continent but extending southwards in the mountains to Colorado and North Carolina, and along the coasts to New Jersey and northern California. Only one species has hitherto been met with in Colorado.

Evotomys gapperi galei (*gapperi*, for Gapper, an early naturalist; *galei*, for Denis Gale). Colorado
Red-Backed Mouse.

Evotomys galei Merriam, *N. A. Fauna*, No. 4, p. 23 (1890).

Type locality.—Ward, Boulder Co., Colorado, 9,500 feet (Denis Gale).

Measurements.—Total length, 5.3; tail vert., 1.65; hind foot, 0.75.

Description.—(From specimen taken at Lake Moraine, El Paso Co., Colo., altitude 10,250 feet, Aug. 29th): Dorsal stripe or area chestnut; sides, flanks, cheeks, nose, and feet gray; under parts whitish gray, plumbeous bases of hairs showing through. Tail bicolor, grayish white below, blackish above. A specimen from same locality, in winter pelage, taken Dec. 11th, has dorsal area a somewhat lighter, brighter chestnut, and the gray of sides and other parts is lighter and somewhat ochraceous.

Distribution.—This species has been reported from Colorado, Wyoming, and Montana. In Colorado it has been taken in the following counties: Boulder, Grand, Garfield, El Paso, Teller, and San Juan. It ranges high in the mountains, 8,000 feet being about as low as it is taken. It will eventually be reported from all our mountain counties.

Habits.—The Red-backed Voles live in the damp woods and are especially fond of making their homes around and under dead logs. They build their nests under logs and

in burrows. Though mainly nocturnal they are sometimes seen in daytime. They eat seeds of any kind, also grass. They do not hibernate, and Bailey says that they do not lay up any stores of food for winter use.

From four to six young are born in a single litter, and the breeding season seems to be from May into July at least, for very small young were taken at Mud Springs, Garfield County, in the middle of that month.

Genus PHENACOMYS (Grk. *phenax*, an impostor, false, + *mus*, mouse, false mouse, in allusion to the fact that, deceived by external appearances, naturalists long classified the species of the genus with *Microtus*).

Phenacomys Merriam, *N. A. Fauna*, No. 2, p. 28 (1889). Type *P. intermedius*.

Revision, Miller, *Proc. Biol. Soc. Wash.*, xi., p. 8 (1897).

Medium or small-sized voles with short rounded tails less than half the total length, and with the soles of the fore feet with 5 and of the hind feet with 6 tubercles; dentition, i. $\frac{1}{1}$; m. $\frac{3}{8} \times 2 = 16$; lower incisors with short roots ending posteriorly at about the level of the molar teeth; molars distinctly two-rooted in the adult, the pattern of the upper ones showing a series of reëntrant angles approximately equal in depth on both the inner and outer sides, while in the lower molars the angles on the outer side are far deeper than those on the inner.

Some nine or ten species of this genus have been described, they are chiefly confined to the boreal regions of North America extending as far south as the Rocky Mountains of Colorado while one species has been found in California. Two species are recorded from Colorado.

KEY OF THE SPECIES

Color gray.

P. orophilus, p. 103.

Color decidedly ochraceous.

P. preblei, p. 104.

Phenacomys orophilus (Grk. *oros*, mountain, + *philein*, to love). Idaho Mountain Vole.

Phenacomys orophilus Merriam, *N. A. Fauna*, No. 5, p. 65 (1891).

Type locality.—Salmon River Mountains, Idaho, alt. 10,500 ft. (C. H. Merriam and V. Bailey).

Measurements.—Total length, 5.5; tail vert., 1.15; hind foot, 0.70.

Description.—(From specimen taken at Lake Moraine, El Paso Co., altitude 10,250 feet): Above grayish brown, with yellowish tinge; feet and underparts whitish, plumbeous bases of hairs showing through. Tail bicolor, white below, mixed brown and white above.

Distribution.—Miller, in his Synopsis of the Genus, gives the distribution as Hudsonian Zone and parts of Canadian Zone, in the mountains of Alberta, British Columbia, and the western United States south to southern Wyoming, central Idaho, and south central Oregon. I have taken it in Colorado, at Lake Moraine, El Paso County, at an elevation of 10,250 feet. But the one specimen has been taken, and it must be very rare, as much collecting had been done at that locality.

Habits.—But little is known of the habits of these voles. They seem to inhabit the high dryer mountain meadows, and are at times, at least, associated with *Microtus* and *Eutamias*.

Phenacomys preblei (named for E. A. Preble, who collected the first specimen). Preble's Mountain Vole.

Phenacomys preblei Merriam, *Proc. Biol. Soc. Wash.*, xi., p. 45 (1897).

Type locality.—Twin or Lillie's Peak, near Long's Peak, Boulder Co., Colorado. Altitude 9,000 ft.

Measurements.—Total length, 5.1; tail vert., 1.15; hind foot, 0.67.

Description.—(From Merriam *l. c.*): Upper parts clay color, suffused with ochraceous buff, and heavily lined on the back with black-tipped hairs; feet soiled whitish; under parts white, with a yellowish tinge, the plumbeous under color showing through.

Distribution.—Up to the present time Preble's Vole is only known from the type locality, which is Twin or Lillie's Peak, near Long's Peak, and from North Boulder Creek, at about 9,500 feet elevation, taken by R. T. Young.

Habits.—Nothing is known of its habits. Mr. Preble, the collector of the type, states that "the locality was perfectly

dry and had been covered by a forest, most of which had fallen."

Genus FIBER (Lat. *fiber*, a Beaver)

Fiber G. Cuvier, *Leçons Anat. Comp.*, i., tabl. i. (1800). Type *F. zibethicus*.

Rat-like animals of considerable size, reaching 20 ins. or more total length; tail laterally compressed and flattened, and fringed with stiff hairs; ears small and hidden in the fur; hind feet large and set obliquely to the leg so that they can be turned edgewise when carried forward; palms and soles of the feet naked and fringed with hairs and provided with five tubercles only. Skull and dentition closely resembling that of *Microtus*, but the molars rooted in the adults; upper incisors ungrooved; enamel pattern characterized by the reëntrant angles of both the inner and outer sides of the molars being approximately equal.



FIG. 34. MUSKRAT, *Fiber zibethicus*
Skull showing dentition $\times 1\frac{1}{2}$

This genus containing the Muskrats is confined to North America north of the southern border of the United States, though perhaps extending across the Mexican border into

the State of Sonora. In addition to the widely distributed type species several other forms have recently been recognized.

Fiber zibethicus (from Lat. *zibetum*, the odorous substance of the zibet, or civet, in allusion to the musk secreted by the animal). Muskrat.

Castor zibethicus Linn., *Syst. Nat.*, 12th ed., i., p. 79 (1766).

Type locality.—Eastern Canada.

Measurements.—Total length, 22; tail vert., 9.5; hind foot, 3.1.

Description.—(From a specimen taken at Crested Butte, Oct. 16th): The pelage consists of a short, close under fur, brown in color, with long outer guard hairs, dark brown in color; feet dark brown; under parts pale grayish, with longer pale brown hairs scattered through the under fur on belly, but nearly wanting on chin and throat; blackish spot on chin.

Distribution.—The Muskrat is found over entire North America, north of the southern boundary of the United States. In Colorado it may be said to occur in every county where there is enough permanent water for it to swim in, and ranges up to 10,000 feet or more elevation.

Habits.—Muskrats are of semi-aquatic habits and consequently are always found about water. Their dense close fur is adapted to the aquatic life, and the flattened tail is an excellent rudder when swimming. They live in holes in the banks of the streams and ponds, and also build houses of mud and grass similar to those of the beaver, but of course smaller, but the animal has never been known to construct dams.

Its food is largely grass, and such other vegetable matter as it can procure. In some regions it brings the freshwater mussels up from the bottom and by biting the hinge between the two valves opens the shell and devours the contents. Piles of these shells may be seen where the animal has been feasting. It will also eat other animal food. One was seen in a lake near Crested Butte chasing under water a "Water Dog," *Amblystoma tigrinum*, which it finally captured by making a sudden dash forward and seizing it with its teeth. The rat then came to the surface with its prey in its mouth, and

not until then was it seen to be a muskrat, for while the chase was in progress the observers supposed it to be a mink. They have also been accused of eating crippled and dead ducks about the lakes where shooting is done.

The animal is liable to cause harm about dams and irrigating ditches from its habit of burrowing, for its holes in the dams and ditch banks may open very serious leaks and washouts, hence the companies owning reservoirs and ditches sometimes offer bounties for their extermination, whether with any practical result I do not know.

Musk rats are not at all disturbed by the neighborhood of habitations, but are just as much at home near a thickly settled district as miles away from civilization.

While they are of more or less nocturnal habits they are also often seen about during the daylight hours, sometimes swimming and feeding and again sunning themselves on a log or rock, or up in a clump of willows.

Their young are born in the spring, a female taken May 12th, in Grand County contained eight good sized embryos; at Lily, Routt County, the same year, young that were probably out of the nest only two or three weeks were taken July 1st. At Barr, Adams County, very small young, not much larger than adult *Microtus modestus*, were taken May 30th. A muskrat taken June 24th at the Medano Ranch, Costilla County, contained seven embryos, and had been nursing, so this must have been a second litter.

The fur is fine and soft, and has always found a market at some price; in the last twenty years it has varied in price from ten to forty cents for best prime skins, and at present writing is near the highest. Nowadays it is used very much for coat and cloak linings, as well as other fur garments.

Subfamily NEOTOMINÆ

Rat-like animals of rather large dimensions with long tails,

sometimes almost as bushy as that of a squirrel, and sometimes round and scantily haired, more like that of a true rat; skull long and narrow, with a long rostrum; nasals extending back behind the premaxillæ; palate ending about opposite the end of the last molar; molars rooted, but with folded enamel plates simulating the appearance of those of the *Microtinæ*; swelling of the root of the lower incisors on the outside of the mandible.

A small subfamily confined to North America.

Genus NEOTOMA (Grk. *neos*, new + *temnein*, to cut).

Neotoma Say & Ord., *Jour. Acad. Nat. Sci. Phila.*, iv., p. 345 (1825). Type *N. floridana*.

Revision, Merriam, *Proc. Acad. Nat. Sci. Phila.*, p. 244 (1894).

Fore feet with the first digit with a rudimentary nail; hind feet with five digits, all clawed; sole with the usual pads and fairly thickly clothed with hair; skull with the cranium not abruptly constricted in front of the brain-case; anteorbital foramen wide above, compressed into a somewhat narrow slit below; dentition, i. $\frac{1}{1}$; m. $\frac{3}{3} \times 2 = 16$; incisors broad and smooth; molars prismatic, rooted or semi-rooted; crowns flat, their sides invested with enamel forming a series of salient loops and reëntrant angles; crown of posterior lower molar never S-shaped, but with a single loop externally and internally.

Some fifty species of these large rats have been described, chiefly from the southern parts of the United States and from Mexico, though one or two species extend northward into British Columbia, Alberta, and Yukon, and perhaps Alaska. Eight of these have been met with in Colorado and can be distinguished as follows:

KEY OF THE SPECIES

- A. Tail round, short-haired, smooth, and tapering; hind feet comparatively short. (Subgenus **Neotoma**.)
 - a. Gray above, without rufous tinge; pure white below.
 - a'. Larger, total length 13.5 or more; tail short, hardly $\frac{3}{4}$ length of head and body. **N. micropus**, p. 109
 - b'. Smaller, total length about 13.0; tail long, more than $\frac{3}{4}$ length of head and body. **N. albigula warreni**, p. 111

- b. Fulvous or rufous above. Size large; total length 14.0.
N. floridana baileyi, p. 111
- c. Brownish with buffy yellowish wash, black-lined; size medium;
total length about 13.0. **N. fallax**, p. 113
- d. Color pale fulvous, black-lined dorsal area; size small, total
length 11.25. **N. desertorum**, p. 115
- B. Tail very large, bushy, somewhat distichous like that of a
squirrel. (Subgenus **Teonoma**.)
- a. Larger, total length usually over 14.5; pelage washed with
yellowish clay color, rather heavily black-lined above.
N. cinerea orolestes, p. 116
- b. Smaller, length usually under 14.5, tail somewhat less bushy.
- a'. Color yellowish rufous above, lined with black.
N. arizonæ, p. 120
- b'. Color lighter, pale buffy ochraceous, dorsal region some-
what lined with black. **N. cinnamomea**, p. 120

Neotoma micropus (Grk. *mikros*, small, + *pous*, foot, small-footed, rather a misnomer). Baird's Wood-Rat.

Neotoma micropus Baird, *Proc. Acad. Nat. Sci. Phila.*, p. 333 (1855).

Type locality.—Charco Escondido, State of Tamaulipas, Mexico.

Measurements.—Total length, 13.5; tail vert., 5.6; hind foot 1.6.

Description.—(From a specimen taken at Monon, Baca County, Colorado, May 2d): Dark gray above, darkest on flanks, upper surface of tail the same, feet and under parts pure white. This is the only one of our species that is distinctly and clearly gray.

Distribution.—Baird's Wood-rat has been reported from Mexico, Texas, New Mexico, Oklahoma, and Colorado. From Colorado the only records at present are my own; I took it at Monon and heard of it at Springfield, Baca County.

Habits.—In Colorado this rat was found living among the sandstone rocks through which Bear Creek, in Baca County, has worn a channel. Here were many overhanging, shelving places, and cracks and crevices running back into the rock. About these places were found the messes of rubbish which it is the habit of all wood-rats, of whatever species, to collect about their nests and dens. These piles consist of anything portable which the rats may find anywhere about, sticks,

pieces of cactus, bones, "cow-chips," everything in fact that they can carry or drag to the nest will be found there. Bailey says that in Texas this species builds these piles about cactus and thorn bushes, the nest itself being placed in the middle of the pile. The cactus leaves and spines which so often form much of the nest are a great protection against many of their enemies, which are deterred from tearing them open by the presence of these prickly things. But it seems at times almost impossible for the rats themselves to run through this stuff without getting their own feet full of thorns, yet they do it.

Their food consists of any kind of nuts or berries which may be had, of prickly pear and other cactus fruits, and seeds of various kinds.

While mainly of nocturnal habits yet they do move about in the daytime to a certain extent.

They have many enemies, hawks and owls, coyotes, foxes and wildcats, and various species of snakes all prey upon them. Their flesh is white and tender, and Bailey says that it is very good eating, in fact some of the California and Arizona Indians used to catch and eat various species of wood-rats, and they were a favorite article of food with them.

All the wood-rats have a more or less pronounced musky odor, which however does not impregnate their flesh at all but seems to be entirely external. This odor is usually very noticeable about the nests.

The animals have the habit of carrying any portable articles they may find to their nests, and this renders them nuisances about a camp or house.

In Baca County this rat was breeding the last of April and first of May, and the number of young seemed to be three, this being the number of embryos found in three or four cases.

Warren's White-throated Wood-Rat 111

Neotoma albigula warreni (Lat. *albus*, white + *gula*, throat; subspecies named for E. R. Warren).

Warren's White-throated Wood-Rat.

Neotoma albigula warreni, Merriam, *Proc. Biol. Soc. Wash.*, xxi., pp. 143-144 (1908).

Type locality.—Gaume's Ranch, northwest corner of Baca County, Colorado.

Measurements.—Total length, 12.75; tail vert., 5.7; hind foot, 1.5.

Description.—(From a specimen taken at the type locality, May 20th): Gray above, lightly lined with black; sides and cheeks rather ochraceous; flanks gray; tail sharply bicolor, black above, white below; feet and under parts pure clear white.

Distribution.—At present this species is only known from the type locality, and from Irwin's Ranch, in northeastern Las Animas County, where I took it in April, 1909, but it is probably found to the westward, for some distance at least, through the eastern part of Las Animas County.

Habits.—This species was taken exclusively among the ledges of sandstone rocks bordering the gulches and shallow cañons into which the country where it is found is cut up. Here were found its piles of trash about the rocks, and a number of specimens were easily captured. Its associates here were the Nebraska and True's Deer-mice, rock squirrels, and a few chipmunks.

It did not seem to be breeding as early as *N. micropus* in the eastern part of the county, for in the latter part of May the embryos found in pregnant females were small; they were three in number. One taken at Irwin's late in April contained two small embryos.

Neotoma floridana baileyi (for Vernon Bailey).

Bailey's Wood-Rat.

Neotoma baileyi Merriam, *Proc. Biol. Soc. Wash.*, ix., p. 123 (1894).

Type locality.—Valentine, Cherry County, Nebraska.

Measurements.—Total length, 14.3; tail vert., 5.75; hind foot, 1.65.

Description.—(From a specimen taken at Wray, Yuma Co.,

Colo., March 6th): Above yellowish gray, quite heavily lined with black on back; sides rather ochraceous; upper part of tail clear gray; feet and under parts white.



FIG. 35. NEST OF BAILEY'S WOOD-RAT, *Neotoma f. baileyi*
Herman W. Nash, Photo.

Distribution.—Bailey's Wood-rat has been reported from Nebraska, Kansas, Missouri, Oklahoma, Texas, and Colorado. At present the Colorado records are very scattered, and indicate a wide distribution. It has been taken at Wray, Yuma County; at Pueblo; at Fort Lyons, Bent County; Mr. H. G. Smith reports rats' nests in the Arkansas bottom near Holly, Prowers County, which most likely belong to this species. From this data we may at present state that the range is that part of Colorado east of the mountains and north of the Arkansas River, but somewhat south of the river it should meet the ranges of *N. micropus* and *N. a. warreni*.

Habits.—The habits of this species are similar to those already described. At Wray it was found living among the rocks which border the bed of Olive Creek, where the collecting was done. Among these rocks were the piles of sticks and other treasures. Mr. Herman W. Nash states that at Pueblo they build nests about the small tree cactus

which is abundant on the prairie there, much as Bailey describes in the case of *N. micropus*.



FIG. 36. BAILEY'S WOOD-RAT, ON TREE CACTUS

From life, Herman W. Nash, Photo.

Neotoma fallax (Lat. *fallax*, deceptive, deceitful). Gale's Wood-Rat.

Neotoma fallax Merriam, *Proc. Biol. Soc. Wash.*, ix., p. 123, (1894).

Type locality.—Gold Hill, Boulder County, Colorado (Denis Gale).

Measurements.—Total length, 12.75; tail vert., 5.7; hind foot, 1.4.

Description.—(From a specimen taken at Colorado Springs, Nov. 6th): Above dark buffy ochraceous, heavily lined with black on back; head grayer, blackish ring around eye; upper part tail black; feet and entire under parts white.

Distribution.—Thus far Gale's Wood-rat has only been found in Colorado and New Mexico. In the former State, however, it seems to be widely distributed. It has been reported from Larimer, Boulder, El Paso, Fremont, Chaffee, Montezuma, Montrose, and

Mesa counties. This indicates a rather peculiar distribution along the east base of the mountains, and probably up the Arkansas to Salida. The gap between here and the western counties is yet to be filled in, but it seems likely it will be found along the Sangre



FIG. 37. BAILEY'S WOOD-RAT. FEMALE WITH TWO YOUNG
From life, Herman W. Nash, Photo.

de Christo Range, and across at least the southern part of the San Luis Valley, and thus make a connection with the western localities. The species has a vertical range from 8,000 feet down to 4,600 feet, this last being the altitude at Grand Junction, where, however, it did not seem to be very common, though *N. orolestes* was abundant.

Habits.—Wherever I have found it this species was living among the rocks with habits as in the other species.

At Coventry and Bedrock, Montrose County, it was breeding in April, and the litters seemed to be small, two or three in each. In fact, so far as my observations go the round-tailed wood-rats are not as prolific as the bushy-tailed species.



FIG. 38. NEST OF GALE'S WOOD-RAT, *Neotoma fallax*
Under sandstone ledge. E. R. Warren, Photo.

Neotoma desertorum (Lat. *desertus*, a desert). Desert
Wood-Rat.

Neotoma desertorum Merriam, *Proc. Biol. Soc. Wash.*, ix., p. 125 (1894).

Type locality.—Furnace Creek, Death Valley, California (T. S. Palmer).

Measurements.—(From specimen described below): Total length, 11.25; tail vert., 4.8; hind foot, 1.25.

Description.—(From a specimen loaned by Biological Survey, and taken 5 miles west of Rangeley, Rio Blanco Co., Sept. 15, 1906, No. 148012): Above buffy ochraceous, lined with black on back, and grayer on head; basal half of upper side of tail like back, rest of tail grayish black. Feet and under parts white. Easily distinguished from any of the other wood-rats in Colorado by its much smaller size and paler colors.

Distribution.—The Desert Wood-rat has been found in California, Nevada, Utah, and Colorado. In the latter State it has thus far been reported from but one locality, the lower White River Valley, about five miles west of Rangeley, Rio Blanco County, where it

was taken by Cary in 1906. As it is an inhabitant of the Sonoran Zone it probably does not range very far into our State.

Habits.—We have no special information as to the habits of this species in this State. Stephens says that in California it makes its nests both among rocks and about cactus and yucca plants. He says that it breeds in March and April, and that the young are from three to five in number.

Neotoma cinerea orolestes (Lat. *cinereus*, ashy; Grk., *oros*, mountain, + *lestes*, thief, robber). Mountain Rat.

Neotoma orolestes Merriam, *Proc. Biol. Soc. Wash.*, ix., p. 128 (1894).

Type locality.—Twenty miles west of Saguache, Saguache Co., Colo. (J. A. Loring).

Measurements.—Total length, 15.0; tail vert., 6.3; hind foot, 1.75.

Description.—(From a specimen taken at Irwin, Gunnison County, Oct. 21st): Above buffy ochraceous lined with black; top of head grayer; feet and entire under parts white; the upper side of the full bushy tail is gray, from a mixture of blackish and white hairs, and the basal third is somewhat ochraceous. The under side of tail has basal inch ochraceous, the rest white, somewhat yellowish, the white hairs are long and project somewhat beyond the dark hairs of upper side, making an indefinite white fringe and tip. Specimens from Grand Junction are somewhat paler, with grayer, less bushy tail, and are somewhat suggestive of *N. arizonæ*. A specimen taken at Grand Lake, May 9th, is more rufous and brighter, and the black lining of the dorsal area is brighter and sharper, and the tail looks blacker.

Distribution.—This species is found in Colorado and in portions of Wyoming. In Colorado it is very widely distributed over the State from the mountains westward. It is reported from Larimer, Grand, eastern Routt, Rio Blanco, El Paso, Chaffee, Custer, Saguache, Gunnison, Delta, Mesa, Eagle, Summit, and Park counties. It is found over an extremely wide range of altitude, from 4,600 feet at Grand Junction up to timber-line (12,000 ft.) or higher, and seems to make itself at home anywhere. In the lower portions of Montrose and Montezuma counties, and no doubt those parts of San Miguel and Dolores lying between, it is replaced by the Arizona Wood-rat, while in the Escalante Hills in western Routt County, the Cinnamon Wood-rat is found.

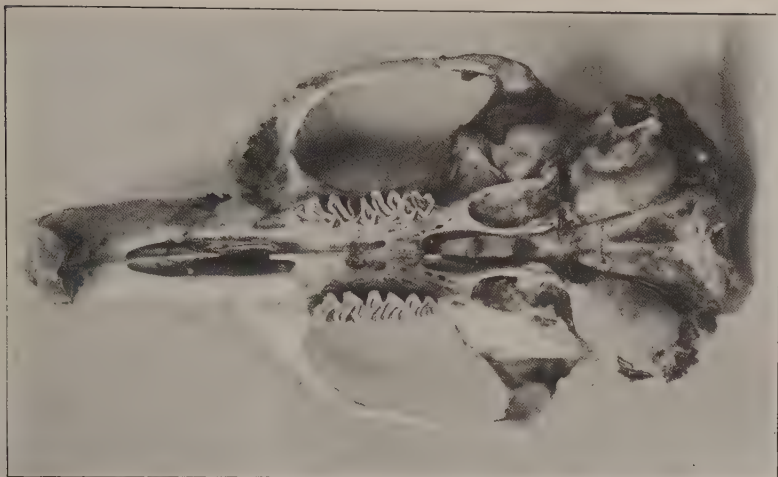


FIG. 39. MOUNTAIN RAT, *Neotoma c. orolestes*
Skull showing dentition $\times 1\frac{1}{2}$

Habits.—This species is the somewhat notorious Mountain Rat, or Pack Rat, as it is often called. This latter name comes from its habit of packing or carrying off any article which it can get hold of. In some localities it is also called "Trade Rat," because it is said that it always leaves something in exchange for what it carries away. It builds nests much as the other species do, amongst rocks, in hollow trees, and various other situations. I have found them in abandoned mine tunnels, about the timbers, and in drifts. I took one in an abandoned tunnel near Querida, Custer County, at a point about 225 feet in from the entrance; it had a nest there, and there was also another nest in a drift close by. There was no indication that the animal had been nearer than a hundred feet to the entrance. While the warm weather lasts they do not trouble habitations very much, but when in the mountains the weather begins to get colder, the rat looks out for a warm place for his winter residence, and

often selects the prospector's cabin or some ranch house. He soon makes his presence known by carrying away any portable articles, and it makes no difference whether they are of any use to the animal or not, so long as it can get away with them. Food of any kind is of course taken, and material



FIG. 40. MOUNTAIN RAT, *Neotoma c. orolestes*
Caught in trap. E. R. Warren, Photo.

for its nest, and, to put it slangily, any old thing, or new either, for it does not pose especially as a collector of antiques. We can recall a case where a cabin at a mine was left vacant all the winter. In the spring, when the miners went back to work, all the knives, forks, and spoons were missing. After a diligent search they were all discovered by tearing up the floor, under which were found the missing articles, carried there by the rats, which had been in undisputed possession all winter. They have been known to carry off sticks of dynamite. It is not known if they ate the latter or not.

Its nests are often made of material apparently procured by shredding gunny sacks, old clothing, and such material as it finds about houses. These are often worked into a globular form, with a hole at the side for an entrance, and make a snug little nest.

This species has the most pronounced musky odor of any of the genus with which I am acquainted, and it is

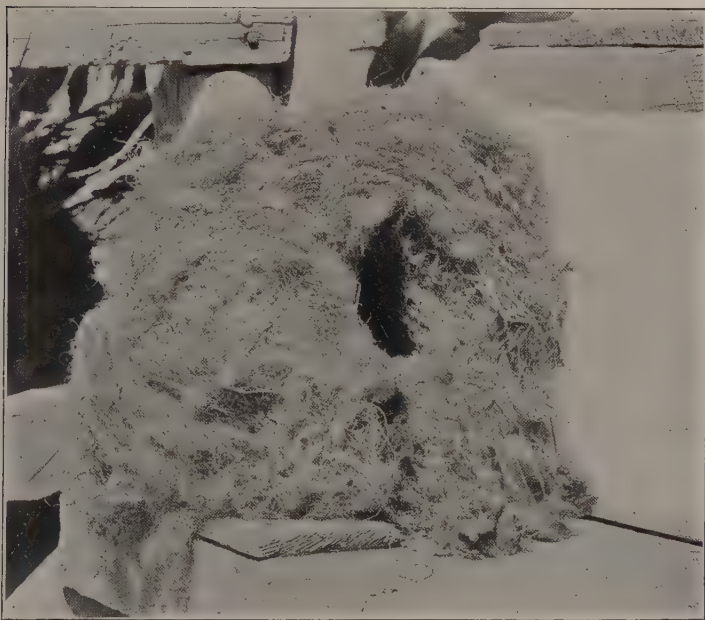


FIG 41. NEST OF MOUNTAIN RAT.

Found on sills under a building, removed to outside and placed on steps in same position with respect to the boards as in its original location. Composed almost entirely of shredded gunny sacks

E. R. Warren, Photo.

remarkably persistent, skins of old males which have been made up for several years still retaining it in apparently its full strength. It is much more persistent than the odor

of a skunk under the same circumstances, for the latter disappears quite quickly.

The young seem to be born, in the mountains at least, in June, probably earlier at lower altitudes. I have no special information as to their number.

Neotoma arizonæ (of Arizona). Arizona Wood-Rat

Neotoma arizonæ Merriam, *Proc. Biol. Soc. Wash.*, viii., p. 110 (1893).

Type locality.—Keam Cañon, Apache County, Arizona.

Measurements.—Total length, 14.3; tail vert., 5.85; hind foot, 1.7.

Description.—(From a specimen taken at Cortez, Montezuma County, April 4th): Above bright ochraceous buff, lined with black; upper part of tail somewhat ochraceous at base, rest gray. Feet and all under parts white. Compared with *oroestes* from Grand Junction it is a more rufous colored animal, and the head is buffy instead of gray.

Distribution.—The Arizona Wood-rat has been reported from Arizona, New Mexico, Utah, and Colorado. In Colorado it is recorded only from the southwestern part of the State, from Montezuma and Montrose counties, and no doubt will be found in the two intervening counties, Dolores and San Miguel. The exact localities were Cortez and Ashbaugh's Ranch, in Montezuma County, and Coventry and Bedrock in Montrose County. Coventry is the highest at which it has been taken, 6,800 feet, and it seems to be rare there, not nearly as common as *N. fallax*.

Habits.—The general habits are much as in other species. It has been found exclusively among rocks in Colorado thus far.

It breeds in April, and bears from four to six young.

Neotoma cinnamomea (Lat. *cinnamomum*, cinnamon).
Cinnamon Wood-Rat.

Neotoma cinnamomea Allen, *Bull. Am. Mus. N. H.*, vii., p. 331 (1895).

Type locality.—Kinney Ranch, Bitter Creek, Sweetwater County, Wyoming.

Measurements.—Total length, 13.5; tail vert., 5.75; hind foot, 1.6.

Description.—(From a specimen taken at Douglas Spring, Routt

County, June 26th): Above rather pale vinaceous buff, rather lightly lined with black on dorsal region; feet and under parts white; tail less bushy than *orolestes* and *arizonæ*, blackish above, white below. As compared with *N. arizonæ* it is a much paler animal of a very different shade of color, the latter being almost rufous in comparison, and with much more black.

Distribution.—The Cinnamon Wood-rat is found in southwestern Wyoming and in northwestern Colorado. In the latter State it has only been found in the Escalante Hills, in western Routt County, where it was taken by myself in 1907.

Habits.—Nothing special is known about the habits of this species. I found it in the rocks. Well grown young were taken in late June.

Subfamily CRICETINÆ

Rodents of rather varying external form in which the molars are tuberculate and rooted; those of the upper jaw having the tubercles arranged in a double longitudinal row instead of in a triple row as in the *Murinæ*: skull rather short and broad with a rather short rostrum and with the bony palate ending about opposite the end of the molars.

A large subfamily of cosmopolitan distribution and of somewhat generalized structure from which it seems probable the more specialized *Murinæ* have been evolved.

Genus REITHRODONTOMYS (Grk. *reithron*, a channel, + *odous*, tooth, + *mus*, mouse, channel or groove-toothed mouse).

Reithrodontomys Giglioli, *Richer. Dist. Geogr. Gen.*, Roma, p. 60 (1873): Type *R. lecontei*.

Revision, Allen, *Bull. Amer. Mus. Nat. Hist.*, vii., p. 125 (1895).

Small, slender, mouse-like rodents with the tail about as long as the body without the head; skull with the anteorbital foramen situated in the zygomatic portion of the maxillary, almost circular above, contracting to a slit below; dentition, i. $\frac{1}{1}$; m. $\frac{3}{3} \times 2 = 16$; upper incisors with a deep longitudinal groove in front, which at once distinguishes this genus from *Peromyscus*, the only genus in Colorado likely to be confused with it; lower incisors simple; anterior upper molars with four roots, three large, one small.

This genus, of which some thirty species have been described, is found in the southern part of the United States, in Mexico and Central America, the bulk of the species coming from Mexico. Only three species have been obtained within the limits of Colorado. They can be distinguished as follows:

- A. Above yellowish brown, mingled with black; sides and rump washed with fulvous; ears small.
R. dychei nebrascensis, p. 122
- B. Above yellowish brown, tinged with rufous; much less black; ears large.
R. megalotis, p. 123
- C. Above mouse-color (like common house mouse), with some fulvous.
R. montanus, p. 123

Reithrodontomys dychei nebrascensis (*dychei*, for L. L. Dyche; *nebrascensis*, of Nebraska). Nebraska
Harvest Mouse.

Reithrodontomys dychei nebrascensis Allen, *Bull. Amer. Mus. Nat. Hist.*, vii., p. 122 (1895).

Type locality.—Kennedy, Cherry County, Nebraska.

Measurements.—Total length, 5.1; tail vert., 2.55; hind foot, 0.45.

Description.—(From a specimen taken at Wray, Yuma Co., Mar. 1st): Above yellowish brown, mingled with blackish hairs, especially on dorsal region, bright rufous hairs at base of ears in front; feet and entire underparts white; upper surface of tail blackish, under part white.

Distribution.—The Nebraska Harvest Mouse has been reported from Nebraska, Kansas, South Dakota, and Colorado. In Colorado it is probably found over much of the eastern part of the State, below the foot-hills, as indicated by the records at hand, it having been taken in Fremont, Boulder, Larimer, Denver, Adams, and Yuma counties. There is still of course much to be learned about its range.

Habits.—This species seems to frequent the weedy borders of fields as much as any other place, and to a certain extent at least lives in nests made of fine grass and other material, and placed on the ground, either among thick bunches of grass or weeds, or under piles of weeds that may have

fallen or been cut down. I found one at Barr under an old piece of sheet iron lying on the prairie.

Its food is seeds and grains, very likely insects, and any meat it may have a chance to get.

One taken at Barr, May 31st, contained four embryos.

Reithrodontomys megalotis (Grk. *megas*, great, + *ous* [*otis*] ear). Big-eared Harvest Mouse.

Reithrodontomys megalotis Baird, *Mamm. N. Am.*, p. 451 (1857).

Type locality.—Between Janos and San Luis Springs, State of Sonora, Mexico (Dr. C. B. R. Kennerly).

Measurements.—Total length, 5.75; tail vert., 2.45; hind foot, 0.45.

Description.—(From a specimen taken at Cortez, Montezuma Co., April 6th): Above yellowish brown, with but few of the blackish hairs found in the preceding species; feet and under parts, including tail, white; tail above blackish. In specimen at hand distinguished from *R. nebrascensis* principally by lighter color without blackish hairs.

Distribution.—This species has been recorded from Mexico, Arizona, New Mexico, Texas, Utah, and Colorado. There are only two records for Colorado at present, Grand Junction, Mesa County, and Cortez, Montezuma County.

Habits.—Little is known about its habits, but they are probably similar to those of the preceding species. My specimen from Cortez was taken among rocks.

Reithrodontomys montanus. Mountain Harvest Mouse

Reithrodontomys montanus Baird, *Proc. Acad. Nat. Sci. Phila.*, p. 335 (1855).

Type locality.—San Luis Valley, probably in Saguache County, but possibly on the northern edge of Costilla County, Colorado (Kreutzfeldt).

Measurements.—(Type from Baird): Total length, 4.2; tail to end of hairs, 2.0; hind foot, 0.5. Specimen in Warren Collection from Crestone: total length, 5.6; tail vert., 2.43; hind foot, 0.5.

Description.—Color above very similar to that of the common house mouse, but somewhat more fulvous; a rusty spot at anterior base of ear; beneath dull white with pale buffy tinge or wash on throat and between fore legs; the fulvous along the sides is almost

distinct enough to form a lateral line; tail rather indistinctly bicolor, blackish above, whitish below, and very scantily haired. This description is made from a specimen in the Warren Collection, taken at Crestone.

Distribution.—This species has only been taken in the San Luis Valley, and as only the type specimen was known for over fifty years, and its exact locality was unknown, not much can be said about its range. Cary has recently taken it at the Medano Ranch, near the San Luis Lakes, Costilla County, and in October, 1909, I took one at Crestone, Saguache County, and have had for some time fragments of one from the same place.

Habits.—These are no doubt similar to those of the other species. The Crestone specimen was taken among weeds at the edge of a field, and at the same place Deer-mice and House Mice were taken. This specimen contained five good-sized embryos.

Genus ONYCHOMYS (Grk. *onux*, a nail or claw, + *mus*, mouse)

Onychomys Baird, *N. Amer. Mamm.*, p. 458 (1857). Type *O. leucogaster*.

Small, rather thick-set rodents with a very short tail always less than half the length of the body; ears short and rather hairy; claws, especially those of the fore feet, long and strong; soles of the hind feet with the proximal two thirds thickly furred and with only the four anterior small tubercles, the larger posterior ones wanting; dentition, i. $\frac{1}{1}$; m. $\frac{3}{3} \times 2 = 16$; both upper and lower molars with a double row of cusps only.

About ten species of this genus have been described, all from west of the Mississippi Valley, and extending southwards into Mexico; only two species are found in Colorado.

KEY OF THE SPECIES

- A. Color more tawny above, upper surface of tail with black hairs.
O. leucogaster pallescens, p. 125
- B. Back grayish, sides and flanks tawny; upper surface of tail like the sides.
O. leucogaster brevicaudus, p. 126

Onychomys leucogaster pallescens (Grk. *leukos*, white,
+ *gaster*, stomach; Lat. *pallescere*, to grow pale).

Pale Grasshopper Mouse.

Onychomys melanophrys pallescens Merriam, *N. A. Fauna*, No. 3,
p. 61 (1890).

Type locality.—Moki Pueblo, Apache Co., Arizona.

Measurements.—Total length, 5.5; tail vert., 1.60; hind foot, 0.8.

Description.—(From a specimen taken April 26th, at Colorado Springs): Above, tawny, with black hairs sparsely intermingled above, the sides and flanks being free from the black; ears blackish, edged with white; upper surfaces of feet white; body beneath white; tail bicolor, white below, upper half body color mixed with black, and a variable white tip. The colors vary considerably, some specimens being quite reddish, especially some in the Warren Collection from Coventry, Montrose Co. The young of this genus have a blue pelage, similar to that of *Peromyscus*.

Distribution.—This species is found over all the plains portion of eastern Colorado, going into the foot-hills but little, if at all. It has also been taken in the San Luis Valley, at Salida, at Westcliffe, Custer County, and at Coventry, Montrose County. It no doubt occurs in other localities in western Colorado, from which, at present, we have no records.

Habits.—The Grasshopper Mice live in holes, either dug by themselves, or they take possession of the abandoned holes of other animals. They are sometimes captured in old prairie-dog holes, and in the old holes of spermophiles. Their comparatively strong fore paws are fairly well fitted for digging, and no doubt they excavate much for themselves. Their food, as one might guess from their common name, consists largely of insects, and likely enough they eat many grasshoppers. Dr. Merriam speaks of finding many scorpions in their stomachs in Arizona. They also eat seeds of any kind they may find, and in fact are omnivorous; but one that I kept in captivity several days would eat meat in preference to anything else. Bailey, in *Biological Survey of Texas*, says: "The *Onychomys* stomachs usually contain, besides finely chewed seeds and grain, an interesting assortment of grasshoppers, crickets,

beetles, scorpions, and small insects and occasionally parts of a lizard or mouse." It is no doubt at times responsible for the destruction, in the collector's traps, of specimens which are often eaten before the collector can get around to them, but other animals must take their share of the blame, for deer-mice and spermophiles will do the same thing.

The Grasshopper Mice breed in spring and early summer, bringing forth from three to six young in a litter; probably, judging from examinations made of pregnant females, four is about the usual number.

It seems probable that these mice may be regarded as rather beneficial than otherwise. They do not seem disposed to injure crops in any way, and must certainly destroy considerable numbers of noxious insects.

Onychomys leucogaster brevicaudus (Lat. *brevis*, short, + *cauda* tail). Short-tailed Grasshopper Mouse.

Onychomys leucogaster brevicaudus Merriam, *N. A. Fauna*, No. 5, p. 52 (1891).

Type locality.—Blackfoot, Idaho (V. Bailey and B. H. Dutcher).

Measurements.—Total length, 5.5; tail vert., 1.6; hind foot, 0.8.

Description.—(From a specimen taken on the Snake River, western Routt Co., June 21st): Above, grayish, especially on shoulders, darker on rump; sides and flanks tawny; upper surfaces of feet and entire underparts white. White hairs in front of ear at base, and whole ear grayer than in *pallescens*. Basal two thirds of upper part tail dark tawny, tip white.

Distribution.—This species is found in northwestern Colorado, on the sage plains of the North Park, in Larimer County, and north of the Bear River, Routt County. Cary took it at Canadian Creek, east of Walden, North Park; Snake River, south of Sunny Peak, and Bear River south of Lay, Routt County. Allen records one from Honnold, Routt County. I took it at Craig, and on Snake River, seven miles north of Lily, Routt County.

Habits.—The habits of this species are undoubtedly similar to those of the preceding. I have no special information regarding them.

Genus **PEROMYSCUS** (Grk. *pera*, pouch, + *myscus*, diminutive of *mus*, little pouched mouse).

Peromyscus Gloger, *Handb. und Hillsb. Naturg.*, i., p. 95 (1841).
Type, *P. leucopus noveboracensis*.

Revision, Osgood, *North American Fauna*, No. 28, 1909.

Small mouse-like rodents with ears of varying size but often very large and rather hairless, nearly always projecting well beyond the fur; feet always white colored; tail long, bicolored, smooth, and moderately hairy, often tufted at the extremity and always more than half the length of the body; soles of the hind feet with the usual six pads, the posterior part of the sole being slightly hairy; skull with the brain-case rather flattened; dentition, i. $\frac{1}{1}$; m. $\frac{3}{8} \times 2 = 16$; molars decreasing in size from in front backwards, when unworn with a distinct double line of tubercles; incisors smooth, not grooved. The young of this genus, in common with those of *Onychomys*, have a "blue" pelage, entirely distinct from that of the adults, and often persisting until the animal attains practically its full size.

Of this genus containing the Deer-mice an enormous number of species have been described. Osgood's recent monograph of the genus gives 43 full species, and the grand total, including all the subspecies, is 142, which are spread all over North America from the Arctic Circle down into southern Mexico. Eight of these have been recorded from Colorado.

KEY OF THE SPECIES

- A. Ears short and rounded; tail not pencilled, usually less than half the total length.
 - a. Smaller. Total length usually less than 6.5.
 - a'. Darker and brighter rufous. **P. m. rufinus**, p. 128
 - b'. Paler and duller. **P. m. nebrascensis**, p. 131
 - c'. Light tawny in color. **P. m. luteus**, p. 132
 - b. Larger. Total length usually above 7. **P. l. tornillo**, p. 133
- B. Ears large, but hardly equal to their distance from the tip of nose. Tail very long, more than half the total length, distinctly pencilled.
 - a. Bright tawny yellow above, with patch of yellow on breast below. **P. c. auripectus**, p. 133
 - b. Brown, mixed with blackish and white on back. No breast patches or spots. **P. b. rowleyi**, p. 134

- C. Ears very large; their length quite equal to or exceeding their distance from tip of nose. Tail distinctly pencilled, about equal to half the total length.
- a. Fulvous, rather grayish above. Ears larger, about 0.95. **P. truei**, p. 135
- b. Darker above, mixed blackish and grayish with dull fulvous ground color. Ears smaller, about 0.8. **P. nasutus**, p. 136

Peromyscus maniculatus rufinus (Lat. *rufus*, reddish).

Tawny Deer-Mouse.

Hesperomys leucopus rufinus Merriam, *N. A. Fauna*, No. 3, p. 65 (1890).

Type locality.—San Francisco Mountain, Arizona (altitude 9,000 feet).

Measurements.—Total length, 6.3; tail vert., 2.75; hind foot, 0.78.

Description.—(From specimen taken at Crested Butte, Oct. 19th): Above tawny brown, darkest on dorsal region, brightest on sides of flanks; white at base of ear; upper surface of tail blackish; feet and all under parts white. The color varies much, and may be much darker than the specimen from which the description was drawn up, and the differences seem to be independent of sex, season, or locality. The color of the dark portion of the tail may vary from that of the body to quite black.

Distribution.—The Tawny Deer-mouse is found in eastern Arizona, eastern Utah,¹ Colorado, and New Mexico. Its range in Colorado may be defined as follows: from the eastern foot-hills of the Continental Divide, and from west of the Pike's Peak Range, west to the Utah line, and from the north to the south boundary of the State, excepting that in most of Routt and Rio Blanco, and western Garfield and Mesa counties it is replaced by *P. nebrascensis*. The following list of localities shows its distribution better than it can be described otherwise: Canadian Creek, Pearl, Rabbit Ear Mts., Estes Park, and Long's Peak, Larimer County; Boulder, Nederland, and Gold Hill, Boulder County (these are all noted by Osgood as approaching *nebrascensis*); Black Hawk, Gilpin County; Golden, Jefferson County; Mt. McClellan, Clear Creek County; Grand Lake, Sulphur Springs, Kremmling, Coulter, Sheephorn Pass and Whiteley, Grand County; McCoy and Allenton, Eagle County; Toponas and Elkhead Mountains, Routt County; Mud Springs, White River Plateau, 12 miles above Glenwood Springs, and Rifle, Garfield County; Debeque, Mesa County; Boreas Pass, Summit County; Tarryall Creek, above Puma City, Park County; Irwin, Crested Butte, Almont, Muddy Creek and Sapinero, Gunnison County;

Uncompahgre Plateau, Coventry, Naturita, and Bedrock, Montrose County; Silverton, San Juan County; Hermit, Hinsdale County; Santa Maria Lake and Wagon Wheel Gap, Mineral County; Salida, and Poncha Pass, Chaffee County; Westcliffe, Querida, and Hard-scrabble Cañon, Custer County; Mosca, Hooper, Medano Ranch, San Luis Lake, Mosca Creek, and Fort Garland, Costilla County; Antonito and Conejos River, Conejos County; Pagosa Springs and Arboles, Archuleta County; Del Norte, Rio Grande County; Durango Florida, and Bayfield, La Plata County; Cortez, Ashbaugh's Ranch, and Mesa Verde, Montezuma County; Trinidad, Las Animas County; Cañon City and Howard, Fremont County; Villa Grove, Crestone, and Madenos Creek, Saguache County; Muddy Creek, Huerfano County; Marvine Lodge, Rio Blanco County.



FIG. 42. TAWNY DEER-MOUSE, *Peromyscus m. rufinus*
From life, E. R. Warren, Photo.

Habits.—The habits of this and the following species are very similar, and this description of them will suffice for both. They adapt themselves to any elevation, from timber-line, and higher, down to the lowest altitudes of their respective ranges. They are found in the woods, among rocks, and in gulches and arroyos on the prairies. In newly settled districts they find their way into houses, and make themselves at home there as does the common house mouse, by whom,

however, they are either driven out, or before whose advent they retreat. They live in holes among the rocks and in or under logs, and in the ground; in fact, they make themselves at home anywhere. Sometimes they build nests under boards that may happen to be lying on the ground, but I have never known them to utilize an old bird's nest in the manner that an eastern deer-mouse does. Such nests as I have seen in various locations have been made of soft materials of some kind, often fine dry grass, usually made into a globular form with a cavity in the centre. Their food consists of seeds and grains of any kind, insects, and they will eat each other when caught in traps. Stone and Cram, in *American Animals*, state that they are "great lovers of fresh meat and have often been caught in the act of devouring both eggs and young birds." In the regions where the cedars or junipers abound they seem to eat many of the berries of these trees, and doubtless many piñon nuts.

The Deer-mice are practically strictly nocturnal in their habits, and the collector's traps will remain untouched in the daylight hours, in a locality where they abound, and where the morning's visit to the traps will find a good catch of the pretty little fellows. Often they are so abundant that several days' trapping has to be done to thin them out so as to give the less plentiful and more desirable mammals a chance at the traps.

The Deer-mice do not hibernate, though in the very coldest, or in stormy weather, they may remain quiet for a day or two, but as soon as it moderates they begin to stir about again. It is at the approach of winter that they are most common about houses, as then they seek the shelter afforded by the buildings.

Deer-mice breed in spring and summer, and have from four to eight young in a litter, six being probably the average number.

Peromyscus maniculatus nebrascensis. Nebraska
Deer-Mouse.

Hesperomys leucopus nebracensis Mearns, *Bull. Am. Mus. N. H.*,
ii., p. 287 (1890).

Type locality.—Calf Creek, Custer County, Montana.

Measurements.—Total length, 6; tail vert. 2.6; hind foot, 0.78.

Description.—It is very difficult to draw up a description of this species which will differentiate it from the preceding. But as a rule it is a paler, less fulvous form. This difference is not so noticeable in individual specimens, but when series of each form are compared *en masse* the difference is at once apparent.

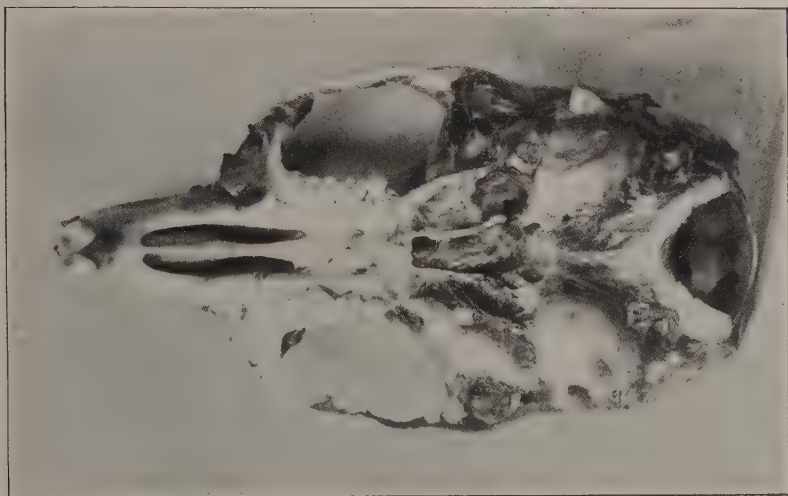


FIG. 43. NEBRASKA DEER-MOUSE, *Peromyscus m. nebrascensis*
Skull showing dentition x 4

The Nebraska Mouse also averages somewhat smaller than the Tawny, though extremes of both are about the same. The color of this species varies somewhat with locality; those taken by myself, near Wray, Yuma Co., being very light tawny and were labelled by Mr. Osgood of the Biological Survey as "approaching *luteus*." Specimens from Routt and Rio Blanco counties seem to grade toward *rufinus*.

Distribution.—The Nebraska Deer-mouse is found from Alberta southwards through Montana, western North and South Dakota,

Wyoming, Colorado, western Oklahoma, and northwest Texas. Its range in Colorado might very well be described as that part of the State not occupied by the preceding species. It has been taken at Yarmany Creek, Eagle County; Yampa, Steamboat Springs, Craig, Lay, Sand Creek, Lily, Snake River, Douglas Spring, Escalante Hills, and Ladore, Routt County; Buford, Meeker, White River, and Rangely, Rio Blanco County; Baxter Pass, Garfield County; Grand Junction and Fruita, Mesa County; Fort Collins and Loveland, Larimer County; Valmont, Boulder County; Barr, Adams County; Littleton, Arapahoe County; Wray, Yuma County; Flagler, Kit Carson County; Eastonville, and Colorado Springs and vicinity, up to at least 11,500 feet, El Paso County; Divide, Teller County; Gaume's Ranch, northwest corner of Baca County; Irwin's Ranch, northeast Las Animas County. Many specimens from points where the ranges of this and the preceding form approach are really intermediate, and in such cases it is necessary to make rather arbitrary decisions as to where to place them.

Habits.—The habits have been sufficiently described under the preceding species.

***Peromyscus maniculatus luteus* (Lat., yellow). Yellow Deer-Mouse.**

Peromyscus luteus Osgood, *Proc. Biol. Soc. Wash.*, xviii., p. 77 (1905).

Type locality.—Kennedy, Cherry Co., Neb.

Measurements.—Total length, 6.0; tail vert., 2.6; hind foot, 0.78.

Description.—(From a specimen taken at Kennedy, Neb., Apr. 23d, Biological Survey No. 18657): Above, rather a bright pale tawny color, darkest on dorsal region, rather whitish around and below ears. Upper portion of tail somewhat darker than the back. Feet and entire underparts white. Easily distinguished in typical form, from either of preceding, though *nebrascensis* is the only one whose range it adjoins.

Distribution.—The Yellow Deer-mouse is, at present, known only from Nebraska, Kansas, South Dakota, Wyoming, and Colorado, and possibly extending into Oklahoma and North Dakota. In Colorado the only positive record is Fort Collins, though specimens from Wray, Yuma County, have been pronounced by W. H. Osgood as very close to *luteus*, which has been taken at Haigler, Nebraska, about eight miles east of the Colorado line, while Wray is the same distance west. Much more information is needed about the distribution of this species.

Habits.—The habits of the species are, as far as is known, so similar to those of the two preceding as to need no special description.

Peromyscus leucopus tornillo (Grk. *leukos*, white, + *pous*, foot, white-footed; *tornillo*, for the "tornillo" or screw bean, among the forests of which it often lives in Texas). Tornillo Deer-Mouse.

Peromyscus tornillo Mearns, *Proc. U. S. N. M.*, xviii., p. 445 (1895).

Type locality.—Rio Grande Valley, 6 miles above El Paso, Texas.

Measurements.—Total length, 7.1; tail vert., 3.2; hind foot, 0.82.

Description.—(From a specimen taken at Lamar, April 8th): Above, dark brown, paler and brighter on sides, darkest on the dorsal region, where a certain amount of black hairs are intermixed. Upper part of tail like back. Feet and underparts white. Easily distinguished from any of preceding by larger size.

Distribution.—The Tornillo Deer-mouse has been taken in western Texas, New Mexico, Arizona, and Colorado, also in northeastern Mexico. In Colorado it is at present known only from Lamar, Prowers County, Monon and Springfield, Baca County, while a single specimen from Gaume's Ranch, in the northwest corner of Baca County was also identified by Osgood as this species, though it seems very like the Nebraska Mouse, which was very common there; the Biological Survey also has specimens from Cañon City.

Habits.—The habits seem to be similar to those of the species already described. At Lamar it was taken about brush heaps in the Arkansas River bottom, and in the Baca County localities it was found living around the rock ledges in the Bear Creek valley. At Monon some were also taken at deserted ranch buildings.

The number of young varies from four to six.

Peromyscus crinitus auripectus (Lat. *aureus*, golden, + *pectus*, breast). Golden-Breasted Deer-Mouse.
Buff-Breasted Cañon Mouse.

Sitomys auripectus Allen, *Bull. Am. Mus. N. H.*, v., p. 75 (1893).

Type locality.—Bluff City, San Juan Co., Utah.

Measurements.—Total length, 6.8; tail vert., 3.5; hind foot, 0.8.

Description.—(From a specimen taken in western Montezuma Co., April 9th): Hair long and silky; above bright buff or tawny, lightest on the sides and flanks, a slight admixture of black hairs in the dorsal region. Feet and under parts white, except yellow spot on breast between fore legs. Tail with distinct pencil; upper part quite dark. Very different from any of the other Colorado deer-mice. Recognized by the yellow breast spot.

Distribution.—The Golden-breasted Deer-mouse has been taken in southeastern Utah, northeastern Arizona, New Mexico, and Colorado. In the latter State it has been met with in Montezuma, Montrose, Mesa, and Garfield counties. The most northeastern record is a specimen taken by myself in the Grand River Cañon, about twelve miles above Glenwood Springs. It does not seem to range much, if any, higher than 7,000 feet elevation, and as it lives exclusively among rocks, its distribution all through this area is no doubt rather spotted. Grand Junction is the most northern point on the west boundary of the State from which there is a record at present, but probably it will be found north of that point.

Habits.—This species, like all the big-eared deer-mice, lives almost exclusively in rocky places, where it makes its home among the holes and crevices in the rocks. Its food and other habits seem to be the same as those of the other species already described.

Peromyscus boyleii rowleyi (*boyleii* for Dr. C. C. Boyle; *rowleyi* for C. P. Rowley, who took the type specimens). Rowley's Deer-Mouse.

Sitomys rowleyi Allen, *Bull. Am. Mus. N. H.*, v., p. 76 (1893).

Type locality.—Nolan's Ranch, San Juan Co., Utah.

Measurements.—Total length, 7.25; tail vert., 3.6; hind foot, 0.8.

Description.—(From a specimen taken at Cortez, Montezuma Co., April 6th): Above, brown, dorsal region with many black and a few white hairs intermixed. Upper surface of the tail like the back. Feet and under parts white. Distinguished from next species by shorter ear, which measures 0.8 in the dry skin.

Distribution.—Rowley's Deer-mouse has been recorded from Utah, Colorado, Arizona, New Mexico, western Texas, and southern California; Lower California, and south in Mexico along the Sierra Madre to central Zacatecas. In Colorado it has been taken in

Montezuma and Montrose counties, at the same localities as True's and the Golden-breasted Deer-mice, but it does not seem to be as common as either of the other two. It has also been taken at Salida, Chaffee County, at a considerable distance from any other recorded locality; and very recently I have taken it at Irwin's Ranch, in northeast Las Animas County, *P. truei* and *P. nebrascensis* being also taken there. It is certainly a very peculiar distribution, and needs much further investigation.

Habits.—This is also one of those species confined, in our State at least, to the cedar and piñon zone, where it lives among the rocky places. Bailey says that in Texas it is often found away from the rocks, but always among the trees above named, and also oaks. He says that its food is largely the berries of the cedar, or juniper, as it should properly be called, and likely enough these berries form much of its food here, as the empty hulls of the berries are abundant about the rocks where it lives.

Peromyscus truei (for F. W. True). True's Deer-Mouse

Hesperomys truei Shufeldt, *Proc. U. S. N. M.*, viii., p. 407 (1885).

Type locality.—Fort Wingate, N. M.

Measurements.—Total length, 7.25; tail vert., 3.5; hind foot, 0.95.

Description.—(From a specimen taken in western Montezuma County, April 9th): Fur moderately long and silky. Upper parts a pale brown, darkest on back caused by a slight mixture of black hairs. Feet and under parts white. Tail with distinct pencil: upper part blackish. Ears very large, 1.0 in specimen described.

Distribution.—True's Deer-mouse is found in eastern California, Nevada, Utah, Arizona, New Mexico, and Colorado, and also Chihuahua, Mexico. In Colorado it has been taken at Rinehart Stage Station, southeast Prowers County; Gaume's Ranch, northwest Baca County; Irwin's Ranch, northeast Las Animas County; Salida, Chaffee County; Ashbaugh's Ranch, Montezuma County; Coventry, Bedrock, and Uncompahgre Plateau, Montrose County; Debeque and Plateau Creek, Mesa County; Glenwood Springs and Rifle, Garfield County; Rangely, Rio Blanco County; Lily and Douglas Spring (Escalante Hills), Routt County; and McCoy, Eagle County. The species does not seem to range much higher than the cedar and piñon zone, a little over 7,000 feet.

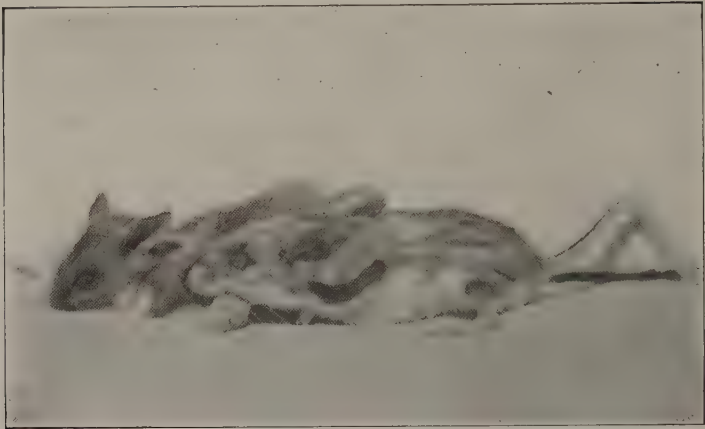


FIG. 44. TAWNY DEER-MOUSE, *P. rufinus* (ON THE LEFT), AND TRUE'S DEER-MOUSE, *P. truei* (ON THE RIGHT)

Photographed from dead specimens to show relative size of ears.
Note large ears of *P. truei*. E. R. Warren, Photo.

Habits.—In common with the other big-eared deer-mice this species seems to prefer to live among rocks, and there it is almost invariably found, though it has been known to take up its abode about a wheat stack. Its food is similar to that of the other species, any kind of seeds, berries, and insects, and a little flesh when it can get it. It breeds in spring and summer, bearing from four to six young in a litter.

Peromyscus nasutus (Lat. *nasus*, nose). Long-nosed Deer-Mouse.

Vesperimus nasutus Allen, *Bull. Amer. Mus. Nat. Hist.*, iii., pp. 299-300 (1891).

Type locality.—Estes Park, Larimer County, Colorado.

Measurements.—Total length, 7.5; tail vert., 3.75; hind foot, 0.95; ear (dried skin), 0.8.

Description.—(From a specimen taken near Colorado Springs, Dec. 22d): Fur hardly as long as in *P. truei*; color above darker, especially on the back, where there is much more black intermixed, in fact only the sides show the pure unmixed ground color; ochra-

ceous shades of color never marked or prominent; feet and under parts white; tail blackish above, more scantily haired than in *P. truei*, and less distinctly pencilled; ear smaller.

From *P. truei* this species may be distinguished by its slightly larger size and smaller ear, and different color, and in the skull by its smaller bullæ. From *P. rowleyi* by its larger size, the colors being somewhat similar, but its pelage is softer and fuller. The skull is of course larger, but the bullæ are relatively no larger than in *rowleyi*.

Distribution.—This species is found in the mountains of Colorado, New Mexico, eastern Arizona, and western Texas, chiefly east of the Continental Divide. In Colorado it has been taken at Estes Park, Gold Hill, Boulder, Colorado Springs, Cañon City, and Trinidad. Near Colorado Springs it lives as high as 8,000 feet.

Habits.—At Colorado Springs I have always found this species about rocks. Its habits and food are like those of the other species. A pregnant female has been taken as late as October 4th.

Subfamily MURINÆ

Rat-like animals with large naked or nearly naked ears, bright eyes, and long scaly tails; skull long and narrow, with the nasals projecting beyond the premaxillæ and the bony palate extending behind the molars; root of the lower incisor causing a swelling on the outer side of the mandible; molars rooted, tuberculate, the tubercles of the upper jaw arranged in three rows, those of the lower jaw in two.

This subfamily is confined to the Old World except for several species introduced by man into America, which have now become entirely naturalized.

Genus MUS (both Greek and Latin, a mouse)

Mus Linn., *Syst. Nat.*, 10th ed., i., p. 59 (1758). Type *M. rattus*.

Ears and eyes large; muzzle naked at the extremity and acute; no cheek pouches; fur generally soft; pollex with a flat nail; tail long, nearly naked, covered with a series of overlapping scales; dentition, i. $\frac{1}{1}$; m. $\frac{3}{3} \times 2 = 16$; no premolars; incisors narrow and not grooved.

This is the largest genus of the whole mammalian class,

comprising over 170 species and is confined to the Old World, but the semi-domestic House Rats and Mice have been introduced almost everywhere into the New by man's agency.

KEY OF THE SPECIES

- A. Larger, total length about 12.0; tail a little shorter than the head and body. **M. norvegicus**, p. 138
 B. Smaller, total length about 7.0; tail longer than the body. **M. musculus**, p. 139

Mus norvegicus (Lat. from or of Norway). Brown Rat

Mus norvegicus Exrl., *Syst. Regn. Anim.*, i., p. 381 (1777).

Type locality.—Norway.

Measurements.—Total length, 12.0; tail vert., 5.6; hind foot, 1.5.

Description.—Above rusty grayish brown; sides grayer; beneath, ashy white; tail above dusky, beneath paler.

The Brown Rat can be easily distinguished by its size, the shortness of its ears and tail, and by its coarse fur.

Distribution.—It is now practically cosmopolitan, having spread inland in various countries from the seaports to which it has been brought from Europe by ships. In Colorado it is found in the larger towns, such as Denver, Colorado Springs, Pueblo, Boulder, Longmont, and Greeley, but so far is not known to have spread into the country.

Habits.—The Brown Rat is well known as a pest about houses and other buildings, but thus far has not gained a very strong foothold in Colorado. Its omnivorous appetite, and its great adaptability to circumstances enable it to live anywhere. It is a pest about storehouses, for it destroys much, and also about granaries it does much damage. It has been in the past few years discovered to be a means of spreading the bubonic plague, and in consequence of that discovery strong efforts are being made in San Francisco and others of our Pacific Coast ports to destroy the rats which are always very numerous in seaport towns. A similar crusade has also been waged against them in the Philippines, in India, and at Cape Town, South Africa.

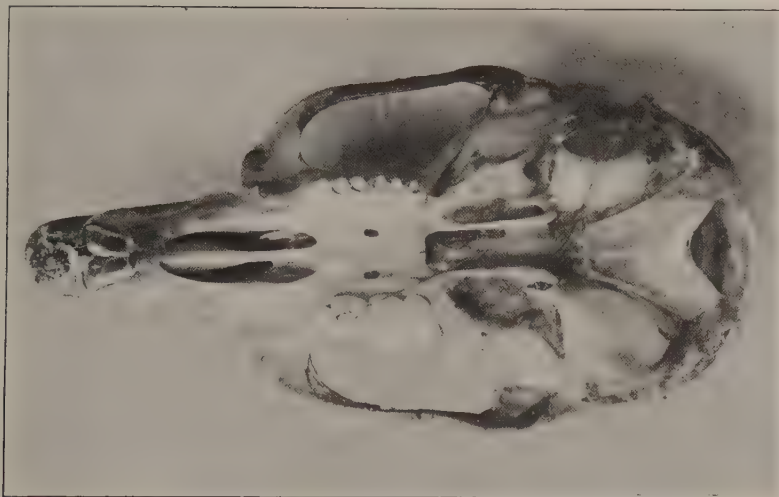


FIG. 45. HOUSE MOUSE, *Mus musculus*
Skull showing dentition x 4

Mus musculus (Lat. diminutive of *mus*, little mouse).
House Mouse.

Mus musculus Linn., *Syst. Nat.*, 10th ed., i., p. 62 (1758).

Type locality.—Sweden.

Measurements.—Total length, 6.5; tail vert., 3.2; hind foot, 0.70.

Description.—Above, grayish brown (mouse color), lined with blackish; beneath, ashy plumbeous, tinged with reddish. Tail dusky; feet ashy brown.

Distribution.—The House Mouse is found all over the world in or about houses; it has been introduced into America from Europe and is now found almost everywhere. In Colorado it is common enough in the settled parts of the State.

Habits.—As its name indicates, this species is a frequenter of houses, and is a well known pest everywhere, as with its small size it can find its way through almost any hole, and so gets into the kitchens and pantries; it nibbles at the food it may find there, and causes the housewife much annoyance. It also takes up its abode in barns and granaries and is often

found out in the fields away from the houses. In fact it seems able to adapt itself to any circumstances, and to find a living anywhere.

In the newly settled districts it soon drives the native deer-mice away from the houses into which they have intruded, or, if it does not actually drive them away, they leave anyway, and leave the field clear for their Old World competitors.

It is a prolific breeder, six to eight young being born in a litter, which soon grow to maturity, and begin bearing young themselves at an early age.

Family CASTORIDÆ

Rodents of comparatively large size and natatorial habits, with a broad, horizontally flattened tail and webbed hind feet; skull massive, without postorbital processes, and with the angle of the mandible rounded; cheek teeth rootless with re-entering enamel folds, two outer and one inner; premolars $\frac{1}{1}$.

This family contains only one genus with two species found in the northern portions of the Old and New Worlds.

Genus CASTOR (Lat., a beaver)

Castor Linn., *Syst. Nat.*, 10th ed., i., p. 58 (1758), type *C. fiber*.

Revision, Rhoads, *Trans. Am. Philos. Soc.*, xix., pp. 417-439 (1898).

Dentition, i. $\frac{1}{1}$; pm. $\frac{1}{1}$; m. $\frac{3}{3} \times 2 = 20$; incisors large and powerful, the lower pair the longer, with chisel-like edges, and colored deep orange-red externally.

The Beavers which are included in this genus are found throughout North America and Europe as far east as the Ural Mountains. Only one species, and that differing but slightly from the European form, is found in North America, but it has recently been split up into several geographical races, one of which inhabits Colorado.



FIG. 46. BEAVER, *Castor canadensis frondator*
Skull showing dentition $\times \frac{3}{4}$

Castor canadensis frondator (Lat. *frondatio*, a stripping off of leaves). Broad-tailed Beaver.

Castor frondator Mearns, *Proc. U. S. Nat. Mus.*, xx., p. 5 (1897).

Type locality.—San Pedro River, Sonora, Mexico.

Measurements.—Total length, 41.5; tail vert., 14.0; hind foot, 7.2; scaly portion of tail, 11.3 $\times$ 4.8.

Description.—(From a specimen taken at Manitou Park): Above, dark red brown, bright and glossy in certain lights, under fur dusky black; sides and head paler; upper surfaces of feet chocolate; underparts similar, but a somewhat lighter shade.

Distribution.—The Beaver was no doubt at one time found in every county in Colorado which contained streams with sufficient water for its needs, and to-day, in spite of the persecution to which it was at one time subjected from the trappers, nearly resulting in its extinction, it is found over a large area of the State, and thanks to the protection accorded it by law, is on the increase. We have records of it from Larimer, Weld, Morgan, Grand, Routt,

Arapahoe, Gunnison, Delta, Garfield, Eagle, El Paso, Teller, and Mineral counties. No doubt it is found in others.



FIG. 47. BEAVER, *Castor c. frondator*.

Side view of skull $\times \frac{7}{10}$

Habits.—The habits of the Beaver are so well known in a general way that it hardly seems worth while to say much about them. The animal lives a semi-aquatic life, always living where there is water, and having its home either in holes in the bank of the stream or pond, or else living in a house or lodge built of sticks and mud. If the water in the stream or pond is not sufficient for its needs a dam may be built to increase the depth of water. These dams are constructed of sticks and mud laid packed together. Sometimes sticks of considerable size may be used, if they happen to be at hand, and again at other times mere twigs are used. Most of the dams which have happened to come to my



A BEAVER DAM; SLATE RIVER, NEAR CRESTED BUTTE, COLO.

E. R. Warren, Photo.



COTTONWOOD TREE CUT BY BEAVER, NEAR MARBLE, GUNNISON COUNTY, COLO.

E. R. Warren, Photo.



A BEAVER HOUSE; NEAR CRESTED BUTTE, COLO.

E. R. Warren, Photo.



A BEAVER HOUSE CUT OPEN

E. R. Warren, Photo.

notice were built of willow branches laid and well mixed with mud to hold them together. Some of them are of considerable size, one hundred feet or more long, and at times ten feet wide. Sometimes in a stream a series of dams may be built, one below the other, and not always clear across the stream, but extending far enough out from the bank to make deep still water.



FIG. 48. BEAVER

From life, E. R. Warren, Photo.

The house or lodge is a round-topped structure rising above the surface of the water sufficiently to allow a cavity above the water level for the bed, which is made of grass. The house has an entrance through a hole or tunnel, which opens at some depth below the surface. A house which I opened near Crested Butte was 10 feet in one dimension, and 8 in the other, across which the opening was made, the chamber or cavity was 2 feet wide and extended back $4\frac{1}{2}$ feet. It measured 10 inches high, but no doubt the roof

may have settled somewhat, as it was an old abandoned house. The thickness of the roof over the chamber was 22 inches, and of the walls on either side 3 feet. A very large house in the same vicinity measured 17 by 22 feet on the water level, and 12 feet along the ridge on top; this was unusually large.

The Beaver's food consists mostly, if not entirely, of the bark of trees and bushes. These it cuts down and gnaws the bark off at its leisure. Generally it cuts off the branches and drags them into the water, and works at them there, and it often stores large quantities of branches in the water for winter use. I found in a pond at Crested Butte willow brush thus stored for a distance of one hundred feet along the shore, in water four feet deep or more, and laid from the bottom to the surface. These willow branches were from three to seven or eight feet long, and it is easily seen that they represent a great amount of work, as well as a good supply of food.

While the Beaver has always been credited with a sufficient amount of intelligence to fell a tree in any direction it wished, and with a certain amount of engineering skill, some of my observations indicate either a lack of intelligence or very poor judgment, for trees were badly felled when there was no excuse for it, and dams built which were simply labor thrown away from an engineering standpoint.

Family SCIURIDÆ

Arboreal or terrestrial forms of moderate size, with long cylindrical hairy tails without scales; skull with distinct postorbital processes and a small infraorbital opening; palate rather broad; premolars $1\frac{1}{4}$ or 2 first upper premolar always small, often deciduous or wanting; molars tuberculate and rooted.

A large family found throughout the world except Australia.

KEY OF THE GENERA

- A. Tail short, less than $\frac{1}{4}$ total length; form stout and thickset; shallow cheek pouches.

- a. Fore feet with four clawed digits; pollex indistinct, with a flat nail; molar series running parallel. **Marmota**, p. 145
- b. Fore feet with five clawed digits; molar series converging behind. **Cynomys**, p. 148
- B. Tails usually long; at least more than $\frac{1}{4}$ the total length.
 - a. Tail hairy, but not bushy, rather shorter than in *b*; ears never tufted and internal cheek pouches always present.
 - a'. Back with a series of five dark and four longitudinal lines. **Eutamias**, p. 170
 - b'. Back with two black stripes enclosing a white one on each side. **Callospermophilus**, p. 166
 - c'. Back with one white stripe on either side. **Ammospermophilus**, p. 164
 - d'. Pattern of markings various, but never as in preceding genera. **Citellus**, p. 155
 - b. Tail long, very broad and bushy; ears pointed, and often tufted; no cheek pouches. **Sciurus**, p. 181

Genus MARMOTA (from *marmot*, Dutch name of European species)

Marmota Frisch, *Nat. Syst. vierfüß. Thiere.*, pl. 9 (1775). Type *M. alpina*.

Form stout and heavy, ears and tail short, the latter about one quarter of total length; cheek pouches very small; fore feet with four clawed digits, pollex rudimentary with a flat nail; skull heavy, postorbital processes well developed, broad at the base, decurved and directed at right angles to the axis of the skull; dentition, i. $\frac{1}{4}$; pm. $\frac{2}{3}$; m. $\frac{3}{8} \times 2 = 22$; incisors broad and strong; molars with only two transverse grooves, in two nearly parallel series hardly converging at all posteriorly; anterior upper premolar nearly as large as the other one.

This genus, containing the animals known as Woodchucks in America and as Marmots in the Old World, is found throughout the northern and mountainous regions of the Old and New Worlds. Only one out of some six described American species has been met with in Colorado.

Marmota flaviventer (Lat. *flavus*, yellow, + *venter*, belly, yellow-bellied). Western Woodchuck.

Arctomys flaviventer Aud. and Bach., *Proc. Acad. Nat. Sci. Phila.*, p. 99 (1841).

Type locality.—"Mountains between Texas and California."

Measurements.—Total length, 23.5; tail vert., 7.0; hind foot, 3.25.

Description.—(From a specimen taken at Sulphur Springs, Grand County, April 13th): Above the pelage is composed of two kinds of hairs, a shorter fine under fur, the basal two thirds of which is black, and the terminal third, and also the less numerous longer coarser hairs, blackish with yellowish white tips; the effect of the

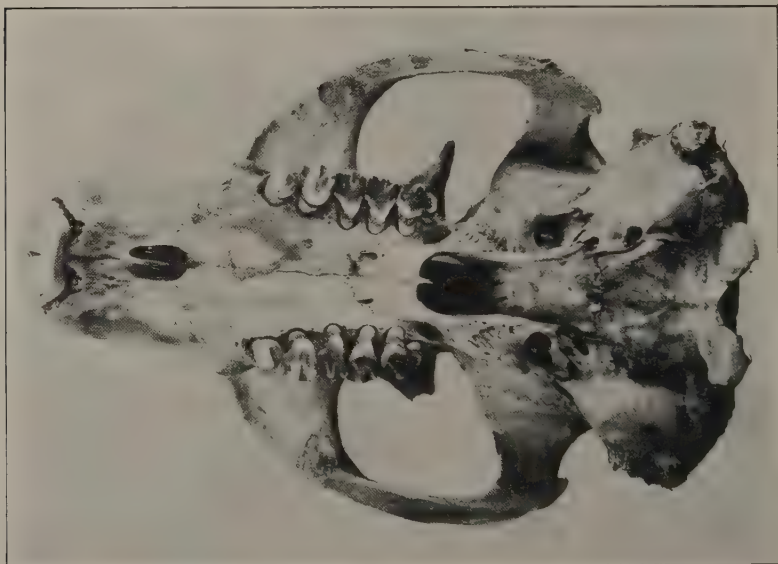


FIG. 49. WESTERN WOODCHUCK, *Marmota flaviventer*
Skull showing dentition, about natural size

whole combination is a grizzled brownish animal; top of head quite black; a mixed brown, black, and white patch between eye and nose; end of nose black; a light buffy patch beside nose, above mouth; cheeks rather grizzled blackish; upper surface of feet dark brown or chestnut; flanks paler, more fulvous; chin white; rest of under parts a bright chestnut; upper part of tail brown, darker on outer two thirds; under part darker, blackish. There is much variation in the color of various individuals. Some are much darker, some are lighter. In worn pelage they are often much redder.

Distribution.—This species is found mainly in the mountains, ranging from timber-line down toward 6,000 feet, the lower limit

varying much, however, and depending, to a certain extent at least, on the character of the country. It seems to prefer rocky ground, and especially the rock slides on the sides of the mountains which are its favorite habitat. It is found from the north to the south boundary of the State, and from the Front Range west to the Utah line, wherever the country suits its needs. It is known from Larimer, Grand, Routt, Boulder, Summit, Eagle, Pitkin, Lake, Chaffee, Gunnison, Rio Blanco, Garfield, Delta, and Montrose counties, and no doubt occurs in the other mountain counties.



FIG. 50. WESTERN WOODCHUCK, *Marmota flaviventer*
Half grown young. From life, E. R. Warren, Photo.

Habits.—As stated above, the Woodchucks prefer rocky ground to live in, and much of the slide rock on our mountains seems to be fairly alive with them late on a summer afternoon when the animals are out securing their evening meal. They live in burrows and crevices among these rocks or else dig holes in the softer ground for homes. They are fond of sunning themselves near the mouths of their holes, and

especially of lying stretched out upon some rock which commands a view of their surroundings. Their food is exclusively vegetable, consisting of the grass and other plants growing near their homes. We have never heard any complaints of this species doing any damage to farm crops, such as are often made against the eastern form, though we have several times found it on ranches in close proximity to cultivated fields. In one way, however, it is sometimes considerable of a nuisance, and that is by entering vacant cabins and houses in the mountains, and gnawing the woodwork of the floors and walls, and any furniture which may be there. Sometimes quite a little damage is thus done, to say nothing of the dirt and débris the animals leave about.

Not very much is known of their breeding habits. Young a fourth to a third grown are seen about the holes early in July, or even late June. A female, taken at Sulphur Springs, Grand County, May 4th, contained eight embryos.

The Woodchuck hibernates, retiring early in autumn, usually, in Gunnison County at least, about the first of October, though individuals may sometimes be seen about much later than this, and even when the snow is quite deep. The date of their appearance in spring varies, being no doubt dependent on two things, the altitude at which the animal is living, which affects the depth of snow and the lateness of its staying, and also on the season, whether late or early. They are likely to come out of winter quarters any time in the early part of April.

Genus CYNOMYS (Grk. *kun*, dog, + *mus*, mouse, literally dog-mouse).

Cynomys Rafinesque, *Amer. Month. Mag.*, ii., p. 45 (1817). Type *C. ludovicianus*.

Stout, thickset, terrestrial and burrowing animals with rudimentary ears and short tails; cheek pouches shallow; fore and hind limbs with five clawed digits; skull heavily built with stout decurved

postorbital processes; dentition, i. $\frac{1}{1}$; pm. $\frac{2}{2}$; m. $\frac{3}{3} \times 2 = 22$; anterior premolar large; molars with 3, not 2, transverse grooves on their crowns; molar series converging behind.

This genus containing the Prairie Dogs is confined to North America west of the Mississippi Valley; seven species are to be found in Elliot's Check-list, three of which inhabit Colorado, and can be distinguished as follows:

KEY OF THE SPECIES

- A. Larger, total length over 14.0; tail with apical third black.
C. ludovicianus, p. 150
- B. Smaller, total length less than 14.0; tail with apical half mixed black and white and tipped with white; head darker than the back; no dark eyebrow.
C. gunnisoni, p. 153
- C. Size as in last; tail with apical $\frac{2}{3}$ white; head same color as back, a distinct dark stripe over the eye and a patch below.
C. leucurus, p. 154

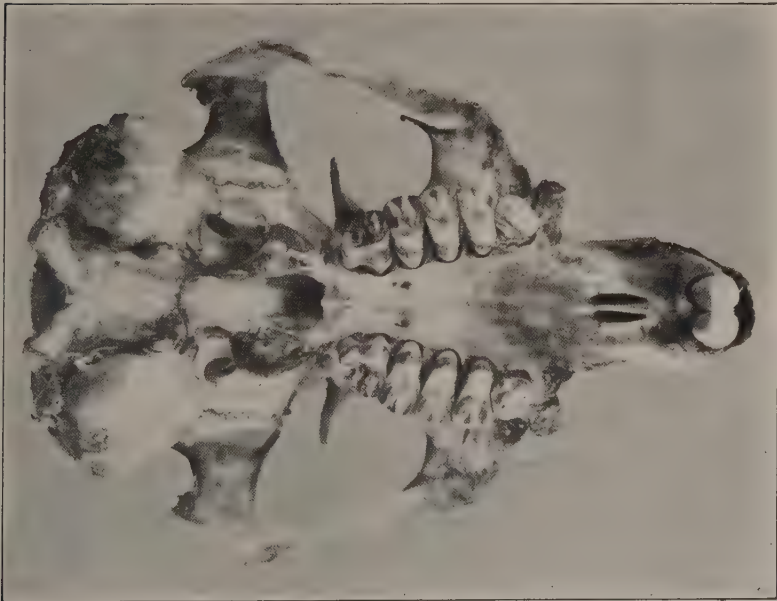


FIG. 51. PLAINS PRAIRIE DOG, *Cynomys ludovicianus*
Skull showing dentition $\times 1\frac{1}{2}$.

Cynomys ludovicianus (Lat., of or from Louisiana).

Plains Prairie Dog.

Arctomys ludovicianus Ord, Guthrie's *Geog.*, 2d. Amer. ed., p. 292 (1817).

Type locality.—Plains of the Upper Missouri.

Measurements.—Total length, 14.25; tail vert., 3.0; hind foot, 2.35.

Description.—(From a specimen taken near Colorado Springs Sept. 8th): Reddish brown above, brightest and clearest on shoulders and top of head; on back and rump somewhat grizzled with black and white hairs; flanks paler, sides of head and body, upper surfaces of feet, lighter, more yellowish; underparts yellowish white; basal two thirds of tail like shoulders, apical one third black; soles black. Spring specimens in the worn winter pelage are somewhat paler.

Distribution.—The Plains Prairie Dog is found throughout the Great Plains from the northern limit of the United States southwards to western Texas, east of the foot-hills of the Rocky Mountains. In Colorado it is found in every county from the base of the mountains to the eastern boundary of the State and in many places is exceedingly common.

Habits.—The Prairie Dog is a notably social burrowing animal, living in communities called dog-towns, of varying extent, sometimes covering many square miles. Vernon Bailey states that in western Texas, just to the east of the Staked Plains, there is an area 250 by 100 miles in extent which is one vast dog-town. This area of 25,000 square miles he estimates to contain at least 400 million Prairie Dogs. The animals are strictly diurnal in their habits, coming out of their burrows at sunrise and disappearing at sunset. In warm weather they are not seen much during the middle of the day, while in cold weather they prefer the middle portion of the day for their outdoor exercise. They spend their time outside in feeding, working at their burrows, visiting their neighbors, and basking and sleeping in the sun. Each burrow is usually protected by a crater-like mound, which prevents the ingress of water. The food consists almost entirely of grass,—roots, stems, and blades,—though other

plants, seeds, and even insects are eaten to some extent. The voice is a kind of bark whence they derive their name. It has been likened to the barking of a young puppy. When approached from a distance they are to be seen sitting upon their hindquarters on top of their mounds, barking a noisy alarm, but at nearer approach they soon vanish into their holes.

In early autumn they get very fat, and in the northern part of their range hibernate at least to a partial extent in winter, but this habit becomes less regular and prolonged in the more southerly parts of their range. Thus in Colorado they may be seen out on fine days all through the winter, but when a cold snap comes they disappear until it is over.

There can be no doubt but that the Prairie Dog has greatly increased in numbers of late years in many districts, partly, no doubt, owing to the destruction of its natural enemies, such as coyotes (though these seem to hold their own pretty well), badgers, hawks, and eagles. Where this is the case they do an enormous amount of harm by destroying grass and pasture land, and have to be kept down by the use of poison or bisulphide of carbon, or better, by a combination of the two.

A burrow was carefully surveyed by Mr. W. H. Osgood, of the Biological Survey, near Alma, Nebraska. He found that the hole went down almost perpendicularly for a distance of about 15 feet; it then turned horizontally for another 9 feet, rising slightly towards the end. Off the horizontal passage was a horizontal nest lined with grass, while several old nests and the end of the horizontal passage had been plugged up with black earth brought from the surface. A little way down the vertical shaft was a side niche where probably the animal could turn around or pass another individual.

The old story of the amicable association of the rattlesnake

and the burrowing owl (*Speotyto cunicularia hypogæa*) with the Prairie Dog in the same burrow is now discredited. There seems to be no doubt, however, that the rattlesnake does feed on young Prairie Dogs, and it is further related by a writer (*American Field*, p. 194, Mar. 11, 1899) that the snakes are mortally afraid of being entombed by Prairie Dogs. If the mother of young dogs on her return to the burrow finds that a snake has intruded she at once sets up a peculiar cry or bark. At once the neighbors respond and gather about the hole and set to work to fill it up, packing and butting down the earth with such vigor at the mouth of the hole that it is soon as hard as the adjacent prairie. I was told the same thing myself when in Baca County but had no opportunity to verify it.

As to the owls, they make use of the deserted burrows for nesting sites, but they would hardly venture into an occupied one since the Prairie Dogs would be quite a good match for them; the owls are just as likely to be found in an abandoned dog-town as in an inhabited one.

The other enemies of the Prairie Dog are the coyote, which lies in wait for them on their exit from their burrows; the badger, which diligently digs them out, and which, if the ranchmen in the dog-infested regions were alive to their own interests, would never be killed; and the black-footed ferret, which pursues them into their burrows.

Prairie Dogs, if captured when young, are easily tamed and make great pets. The one shown in the illustration was taken when quite small, and after a day or two in captivity made no attempt to escape when turned loose out-of-doors, but would follow one all around. It was given its liberty, and took up its abode on the place, living in a hole, but would come to the house to be fed. For some reason it disappeared for a month or so, but reappeared, and was as sociable as ever. This was in a locality where the winters

are cold and it hibernated, coming about again the next spring, and would come to the house, open an unlatched screen door with its paw, and come into the kitchen to beg for bread and sugar, its favorite dainty.

In Colorado Springs, quite a number of years ago, one or two Prairie Dogs, I have forgotten which, occupied a hole on a vacant lot all surrounded by houses, and would feed from children's hands. I do not know their history but presume they were tamed animals which had been turned out.

Cynomys gunnisoni (named for Captain Gunnison, U. S. A., who commanded the expedition by which the first specimens were taken). Gunnison's Prairie Dog.

Cynomys gunnisoni Baird, *Proc. Acad. Nat. Sci. Phila.*, p. 334 (1855).

Type locality.—Cochetopa Pass, Saguache Co., Colo. (Kreutzfeldt).

Measurements.—Total length, 13.25; tail vert., 2.3; hind foot, 2.25.

Description.—(From specimen taken at Wagon Wheel Gap, Mineral Co., July 13th): Color of back and top of head brown, with many black and some white hairs intermixed, giving the animal a blackish appearance; buff line above eye; sides and upper surfaces of feet fulvous; underparts similar, somewhat lighter; tail like back on basal half; rest mixed black and white, tipped with white. A skin taken at Salida, April 1st, has hair longer, and the animal is paler. Young are lighter in color with less black. In many specimens the white of the tail is nearly worn away.

Distribution.—Gunnison's Prairie Dog ranges from South Park and the Leadville district south through the San Luis Valley to New Mexico; it is in Gunnison County east of the Black Mesa, and in southwestern Colorado south of the Uncompahgre Plateau. Of course there are some parts of this region too high for them, but in the suitable locations this is the Prairie Dog found there. It is found in Park, Teller, Lake, Chaffee, Costilla, Custer, Fremont, Saguache, Mineral, Gunnison, western Montrose, San Miguel, and Montezuma counties, and very likely others from which at present records are not available.

Habits.—Similar to those of *C. ludovicianus*, but apparently hibernating more completely.



FIG. 52. WHITE-TAILED PRAIRIE DOG, *Cynomys leucurus*
Half grown young. From life, E. R. Warren, Photo.

Cynomys leucurus (Grk. *leukos*, white, + *urus*, tail).
White-tailed Prairie Dog.

Cynomys leucurus Merriam, *N. A. Fauna*, No. 4, p. 33 (1890).
Vernon Bailey.

Type locality.—Fort Bridger, Uinta County, Wyoming.

Measurements.—Total length, 13.25; tail vert., 2.15; hind foot, 2.25.

Description.—(From specimen taken in Routt Co., near Snake River, June 19th): Similar in color above to *gunnisoni* but paler, and hardly as much black intermixed; a prominent black mark over eye, and a blackish patch on cheek below eye; chin whitish; sides, tops of feet, and underparts pale fulvous; base of tail like back; outer two thirds white with a few black hairs, under surface of tail similar but white with no black hairs, and rather yellowish. While about the same length as *gunnisoni* the present species seems to be a rather bulky, heavier animal. The black markings above and below eye are very distinctive characters.

Distribution.—This is the Prairie Dog of northwestern Colorado and of North Park, in Larimer County. Besides the above named county it is found in Routt, Rio Blanco, Eagle, Mesa, Delta, eastern Montrose, Ouray, and possibly extreme western Gunnison counties.

Habits.—Very similar to those of the other species. In Routt County the old males were found to be extremely fat in late June, and presented a truly aldermanic appearance as they sat on their mounds barking at the passer-by. They were then in excellent pelage, while the adult females were still in worn winter coat, and not at all fat, not having yet had time to recuperate from their labors in raising families.

Genus CITELLUS (Lat., diminutive of *citius*, swift)

Citellus Oken, *Lehrb. der Naturg.*, ii., p. 842 (1816). Type, *Citellus citellus*.

Squirrel-like animals of terrestrial and burrowing habits with tails of varying length but never quite so bushy as in the true squirrels; cheek pouches always present; skull with somewhat slender postorbital processes backwardly directed; anteorbital foramen oval or circular with a marked tubercle on its outer lower border; dentition i., $\frac{1}{1}$; pm., $\frac{2}{1}$; m.; $\frac{3}{3} \times 2 = 22$.

The members of this genus are distributed over the whole of the northern temperate regions of both hemispheres from eastern Europe across northern Asia, to North America. Forty-three North American species are recognized by Elliot in his Check-list, distributed chiefly over the western two thirds of the country from Alaska to the state of Vera Cruz in Mexico. Up to the present ten species and subspecies have been found within the limits of Colorado.

KEY OF THE SPECIES

- A. Size smaller, total length under 12.0; tail shorter, less than $\frac{3}{4}$ the length of the body.
 - a. No lateral or other stripes.
 - a'. Uniform speckled black and yellowish above; tail short, less than $\frac{1}{2}$ the length of the body. **C. elegans**, p. 156
 - b'. Hinder part of the body indistinctly spotted with white, each spot bordered posteriorly with black; tail longer, about $\frac{1}{2}$ the length of the body.
 - a''. General color above cinnamon brown, well spotted, extending to shoulders. **C. spilosoma major**, p. 157

- b". General color above grayer, not so heavily spotted, spots only extending forward to middle of back.

C. obsoletus, p. 158

- b. Back pale yellow, marked with five to seven longitudinal bands, the bands spotted with the ground color.

a'. Size larger, length, 9.0-9.5; hind foot, 1.3. *C. t. pallidus*, p. 159

b'. Size smaller, length, 7.85; hind foot, 1.13. *C. t. parvus*, p. 161

- B. Size large, over 15.5 in length; tail long, over $\frac{3}{4}$ length of body.

- a. Posterior portion of body somewhat tinged with rufous; tail proportionately not quite as long as in the next.

C. v. grammurus, p. 162

- b. Posterior portion of body more strongly tinged with rufous; tail somewhat longer in proportion to body. *C. v. utah*, p. 163

***Citellus elegans* (Lat., neat, fine, elegant). Wyoming
Spermophile, Picket-Pin Gopher.**

Spermophilus elegans Kennicott, *Proc. Acad. Nat. Sci. Phila.* p. 158 (1863).

Type locality.—Fort Bridger, Uinta Co., Wyoming (C. Drexler).

Measurements.—Total length, 10.8; tail vert., 3.0; hind foot, 1.75.

Description.—(From a specimen taken in Coyote Basin, Routt Co., July 2d): Upper parts brown, with an indistinct mottled or spotted appearance caused by the tips of the hairs being black; in some lights the animal seems to be transversely crossed by narrow irregular wavy black lines; top of head like back but without the spotted appearance; sides, flanks, and upper surface of feet pale fulvous; underparts (except chin) a somewhat paler shade of fulvous; chin whitish; light whitish-buff ring around eye; tail above mixed brown and black, tip black edged with whitish; below brown or fulvous, about like sides, with black tip. Specimens in spring, in worn pelage, are somewhat grayer and paler.

Distribution.—This species is found in Wyoming, Colorado, and Utah. In Colorado it has been found in Larimer, Grand, Routt, Rio Blanco, Eagle, and Summit counties, at elevations from a little below 6,000 up to 9,000 feet. Fish Creek, Larimer County, near the Wyoming line, is the most northeasterly Colorado record; I found it in Routt County to about ten miles west of Lay; Minturn, Eagle County, and Dickey, Summit County, are the most southern records.

Habits.—The Picket-pin Gopher is a burrowing animal, living in colonies like prairie dogs, though not throwing up large mounds like the latter, nor, being a smaller animal, do

they dig as large burrows. They frequent the more open ground, though often living among the sage-brush and greasewood. Their food is varied. They live on grasses, seeds, and other vegetable matter and do not refuse meat as well. They have been said to have eaten of the dead buffalo on the plains in bygone days and very likely eat grasshoppers and other larger insects. They go into winter quarters in early fall, hibernating until about April 1st, when they reappear. At Sulphur Springs, in April, I found them running about in fresh snow on stormy days. The breeding season seems to begin almost at once on their coming out in spring, and young just large enough to come to the mouth of the hole were seen in Grand County May 17th. The litters seen by me were from four to six in number.

The animal receives its vernacular name of Picket-pin Gopher from its habit of sitting upright by its hole, looking like a stake. While this name seems to be in quite general use in Wyoming, in Colorado it is not so much used, and in most localities the animals seem to be known simply as "Ground Squirrels." They are known to do damage to crops, cutting down young grain and corn, and also carrying away the ripened grain to their storehouses.

Citellus spilosoma major (Grk. *spilos*, a spot; Lat. *major*, elder, adult, larger). Large Spotted Spermophile.

Spermophilus spilosoma major Merriam, *N. A. Fauna*, No. 4, p. 39 (1890).

Type locality.—Albuquerque, Bernalillo County, New Mexico.

Measurements.—Total length, 8.75; tail vert., 2.35; hind foot, 1.4.

Description.—(From a specimen taken at Monon, Baca County, April 30th): Above, cinnamon brown, with indistinct whitish spots with black posterior edges, the spots extending forward nearly to the shoulders; white ring around eye; upper surfaces of feet yellowish white; below white; upper surface of tail like the back, white edged, a substantial blackish band, white tipped; below paler, with much white.

Distribution.—This species is found in eastern New Mexico, western Texas and Oklahoma, southwestern Kansas, and south-eastern Colorado. Its range in Colorado is not very well worked out; it is found near Pueblo, where it seems to be the common species of *Spermophile*, and is found thence east to the Kansas line; just how far north it goes I do not know. One has been taken near Denver. I have taken it at Lamar, Prowers County, and at Monon, Baca County.

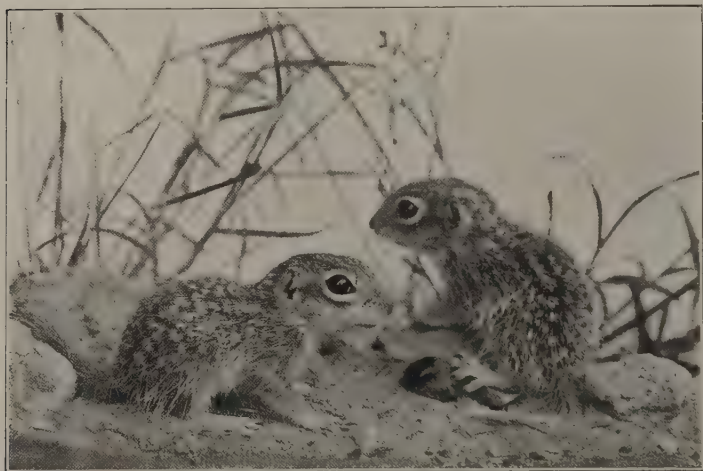


FIG. 53. LARGE SPOTTED SPERMOPHILES, *Citellus spilosoma major* (Young.) From life. Herman W. Nash, Photo.

Habits.—The habits of this species are similar in many respects to those of *C. tridecemlineatus pallidus*, described beyond. They are rather shy and quiet little animals, and from what little I have seen of them seem to prefer the sandy soils. Those which I took at Lamar and Monon were living in burrows under yuccas, in the same places as the kangaroo rats.

Citellus obsoletus (Lat. *obsoletus*, worn out). Kennicott's *Spermophile*.

Spermophilus obsoletus Kennicott, *Proc. Acad. Nat. Sci. Phila.*, p. 157 (1863).

Type locality.—O'Fallon's Bluff on the Platte River, in western Nebraska.

Measurements.—Total length, 8.75; tail vert., 2.70; hind foot, 1.25.

Description.—(From a specimen taken at Sterling, Logan County, Colorado, July 24th): Similar to the preceding, but general tone grayer and duller, the spots with not as much white and more black, and not extending quite as far forward. Upper surface of tail with many black hairs and lacking the white edging; tail below whitish.

Distribution.—This species is found in Nebraska, eastern Wyoming, South Dakota, south of the Black Hills, and eastern Colorado. In Colorado it has been taken at Wray, Yuma County; Sterling, Logan County; and Greeley, Weld County. It ranges south to about Lat. 40° and west to Lon. 104°.

Habits.—The habits of this species are similar to those of *C. t. pallidus*. Its food is much the same, but as it is not as numerous as the other it is probably not as harmful. According to Bailey it bears as many as eight young in a litter.

Citellus tridecemlineatus pallidus (Lat. *tridecem*, 13,
+ *linea*, a line; *pallidus*, pale). Striped
Spermophile, Striped Gopher.

Spermophilus tridecemlineatus pallidus Allen, *Monog. N. A. Rodentia*, p. 872 (1877).

Type locality.—Plains of the Lower Yellowstone River, Montana.

Measurements.—Total length, 9.0; tail vert., 3.0; hind foot, 1.25.

Description.—(From a specimen taken at Colorado Springs, Sept. 8th): Striped above, six light and seven dark longitudinal stripes; the light stripes a yellowish gray color, some at least of the hairs black tipped; dark stripes a dark brown, almost black sometimes; all these stripes, except outer one on each side, have a row of spots in centre, of same color as light stripes; outer dark stripe unspotted and ill defined; top of head irregularly marked with colors of back; flanks somewhat rusty; buffy ring around eye; sides and upper surfaces of feet and under parts similar color to light stripes but somewhat lighter and more yellowish; chin whitish; tail above indistinctly banded black and yellowish white, latter color on tips of hairs, and on tip of tail; under surface of tail the same color as under part of body.

In spring, in the worn pelage of preceding year, the animal is somewhat paler.

In young specimens, though practically full grown, the stripes and spots look finer and narrower. Specimens from Divide, Teller County, 9,200 feet, are darker than Colorado Springs examples taken at same season (September).

Distribution.—With its subspecies *C. tridecemlineatus* has a range from the Saskatchewan on the north to northern Texas on the south, and from northeastern Utah, Colorado, and Wyoming to Michigan. The present subspecies inhabits the arid plains from Montana, Wyoming, and Nebraska to Texas. In Colorado it is found over most of the plains country of the eastern part of the State from the foot-hills east, and inhabits every county of that part of the State. It is found in the South Park, and has been taken at Twin Lakes, near Leadville. Its range in altitude carries it to above 9,000 feet.

Habits.—This little spermophile is often seen darting through the grass or standing up erect and motionless on its hindquarters to observe the passer-by. It has a very characteristic note, which may be described as a rapid trill or trembling whistle long drawn out in a somewhat high key. It lives in burrows, some of which it may dig for itself, but it is often found occupying abandoned prairie-dog holes. The burrows constructed by itself usually descend rather steeply at first and then run along horizontally for some distance, those for winter nests or for nurseries being longer than others.

Their food consists of roots, green stuff, and especially of seeds of all sorts, but they also relish beetles, grasshoppers, and other insects. They eat meat, and will devour mice caught in collector's traps, much to the disgust of the collector. In fact they appear to be quite omnivorous. The seeds are carried in their cheek pouches to their storehouses for winter use. In agricultural districts it does much damage by digging up freshly planted seeds, especially of corn and melons, and they also destroy ripe grain.

The young are born in May or June and are from five to eleven in number. At first they are in a very embryonic state,

and it is said that it is nearly a month before their eyes open and their hair comes. They get very fat toward the fall in preparation for their winter sleep which commences in October. Whether they are dormant all the winter appears to be doubtful, but there is always an accumulation of food in their burrows. Some interesting observations on their hibernation have been published by Dr. P. R. Hoy (*Proc. Amer. Ass. Adv. Sci.*, 1875, p. 148). He examined a completely torpid spermophile on December 15th and found the temperature of the abdominal cavity only 58°; the heart was beating only four times a minute, each beat taking about four seconds to complete; there was no sign of respiration, and the circulation was so feeble that hardly any blood issued from an amputated limb; the stomach and bowels were completely empty and there was a thick layer of fat over the body. An examination of the amount of soluble albumen in the muscles in the fall and in the spring showed that there was a great falling off in this respect during the winter.

Citellus tridecemlineatus parvus (Lat. *parvus*, small).

Little Striped Spermophile.

Spermophilus tridecemlineatus parvus Allen, *Bull. Am. Mus. N. H.*, vii., p. 337 (1895).

Type locality.—Uncompahgre Indian Reservation, northeastern Utah.

Measurements.—Total length, 8.0; tail vert., 3.0; hind foot, 1.12.

Description.—Marked and colored like the preceding, though in specimens in the Warren collection the markings do not seem to be quite so sharp. A specimen taken five miles west of Snake River, Routt County, June 22d, is rather grayer in tone, while some taken at Mud Springs, Garfield County, 8,850 feet, July 14th, are a darker richer brown than any specimens of *pallidus* in the same collection.

Distribution.—This subspecies is somewhat irregularly and peculiarly distributed in Colorado. It is found in the desert portions of western Routt and in Rio Blanco counties. It has been met with from near the Wyoming line, in the Snake River watershed, and through that region and west to Utah. It is found in Rio Blanco

County in various places, and east almost to Buford P. O. It is found on the White River Plateau, at Mud Springs, Garfield County, 8,850 feet, and was seen by me on West Fork of Elk Creek, six or eight miles above Newcastle, Garfield County. Specimens from Fort Garland, and Antonito, in the San Luis Valley are referred by the Biological Survey to this form, and I have taken it at Moffat, Saguache County; and Mosca, San Luis Lake, and Medano Ranch, Costilla County. Outside of Colorado it is found in northeastern Utah and southwestern Wyoming.

Habits.—Its habits seem to be much the same as those of the preceding form. At Mud Springs they seemed to be occupying abandoned workings of pocket gophers, which had honeycombed much of the country with their burrows.

Citellus variegatus grammurus (Lat. *variegatus*, made of different sorts or colors; *grammurus*, pertaining to grass). Rock Squirrel.

Sciurus grammurus Say, *Long's Exped. Rocky Mts.*, ii., p. 72 (1823).

Type locality.—Purgatoire River, Colorado, Lat. $37^{\circ} 32'$, Lon. $103^{\circ} 30'$.

Measurements.—Total length, 18.0; tail vert., 7.5; hind foot, 2.35.

Description.—(From specimen taken at Colorado Springs, Sept. 13th): Upper surface of animal, except head, presenting a mottled or dappled appearance; this is due to the fact that the basal half of the hairs is black, and the other part either gray or rusty rufous, with black tips; the rufous area extends along back from behind shoulders to and out into the tail a short distance; the flanks and upper surfaces of feet are rufous, latter rather pale; the sides and neck light gray, top of head grizzled rufous; light ring around eye; chin and throat rusty, rest of under surface of body mixed whitish and rusty.

The tail is quite full and bushy, and except the basal two inches is mixed gray and black both above and below, the black rather predominating above and the gray below; on the basal two inches the gray is replaced by the rufous; the individual hairs of the tail are banded; about one-half inch of base light; then one-quarter inch black, then one-quarter inch light, one-quarter inch black; one-quarter inch light tip. Examined separately these light portions are white, or practically so, but in combination with the black portions produce the gray effect.

The amount of rufous on the back and the brightness of all the colors vary much with individuals, season, and state of pelage. But the size of the animal and bushy tail serve to readily distinguish it from all our other species of the genus except the succeeding.

Distribution.—This species is found from eastern Colorado south and into western Texas, and through New Mexico into eastern Arizona. In Colorado it is found, seemingly from present information, east of the Continental Divide, from about 8,000 feet down. The most northern record in Colorado is Rist Cañon, four miles north of Fort Collins, recorded by W. L. Burnett. It is found at Crestone, Saguache County. This is the only San Luis Valley record I have at present.

Habits.—Both this and the following described subspecies are frequenters of rocky places and according to my observations are comparatively seldom found away from such localities, though sometimes found along brushy streams burrowing in the banks. They are very shy and easily alarmed, and not easily approached.

Their food is seeds and nuts, acorns, and when living near orchards they are known to do considerable damage to such fruits as apricots, by tearing off the soft parts to get at the stone, from which the seed is extracted and carried away. One taken in April at Ashbaugh's ranch in Montezuma County had fifteen apricot pits in its cheek-pouches, which it had evidently taken from its storehouse somewhere. Some of these had begun to germinate a little. One killed in the fruit season had fifty or more pits in its pouches. This was the Utah Rock Squirrel.

A specimen taken in Baca County, May 19th, contained five embryos.

***Citellus variegatus utah.* Utah Rock Squirrel**

Citellus grammurus utah Merriam, *Proc. Biol. Soc. Wash.*, xvi., p. 77 (1903).

Type locality.—Foot of Wasatch Mountains, near Ogden, Utah. (Vernon Bailey.)

Measurements.—Total length, 17–19; tail vert., 7.1–8.25; hind foot, 2.35.

Description.—Colorado specimens in the Warren Collection seem to have the rufous somewhat darker and more intense, otherwise there is but little difference to be seen between this form and *C. v. grammurus*. The tail seems to average somewhat longer in proportion. I am doubtful as to these specimens being after all really referable to *utah*, as they are not so very different from the series of *grammurus* in the same collection, and there is considerable individual variation.

Distribution.—Western Colorado, from 8,000 feet down. Known as far east as Glenwood Springs and a short distance up the Cañon of the Grand above that place; also taken in Montezuma, San Miguel, Montrose, Mesa counties. Seen in Delta and Garfield counties. Outside of Colorado it has been recorded from Utah only.

Habits.—The habits have been sufficiently described under the preceding species.

Genus AMMOSPERMOPHILUS (Grk. *ammos*, sand, + *sperma*, seed, + *philein*, to love. Sand Spermophile.)

Ammospermophilus Merriam, *Proc. Biol. Soc. Wash.*, vii., p. 27 (1893). Type *A. leucurus*.

Small spermophiles or ground squirrels having small ears, and with the tail less than one half the length of head and body. Skull very broad; interorbital constriction slight; nasals short, equal in length to the premaxillaries; rostrum short; dentition as in *Citellus*; first premolar less than half the size of second.

This genus of desert-loving spermophiles is found in the southwestern portions of the United States, from western Colorado to California and southward into Sonora, Mexico, and Lower California. Elliot's Check-list gives eight species and subspecies, one of which is found in Colorado.

***Ammospermophilus leucurus cinnamomeus*.** White-tailed Spermophile. Antelope Squirrel.

Tamias leucurus cinnamomeus Merriam, *N. Am. Fauna*, No. 3, p. 52 (1890).

Type locality.—Echo Cliffs, Painted Desert, Coconino County, Arizona. (Merriam and Bailey.)

Measurements.—Total length, 8.50; tail vert., 2.50; hind foot, 1.60.

Description.—(From specimen taken at Grand Junction, Oct. 3d): Back grizzled, black, white, and rufous; top of head rufous, very little black intermixed; a distinct white stripe on either side of back, about one eighth of an inch wide, extending from shoulder to hip; shoulders, sides of body below stripe and flanks, and upper surfaces of feet, a light rufous or cinnamon color; light ring about eye; under surface of body white; upper surface of tail black, white edged, under surface white, mixed black and white border and tip.

An April-caught specimen from Montezuma County has the hair longer and silkier, but colors are exactly the same. The general tone of the coloration of the animal is cinnamon.

Distribution.—This species is found in northern Arizona, southern Utah, southwestern Colorado, and northeastern New Mexico.

An inhabitant of the Lower Sonoran and lower portions of the Upper Sonoran Zones, it is found in the less elevated districts of southwestern Colorado, from Grand Junction up the Gunnison to Hotchkiss, and presumably it is also found up the Grand River some distance. It has been met with near Montrose, near Coventry, Montrose County, 6,800 feet, and at Bedrock, in the same county; also in western Montezuma County.

Habits.—The Antelope Squirrel is found about rocky places to a certain extent, at least; also amongst the sagebrush and greasewood. Its food and habits are similar to those of the other ground squirrels. As the animal runs it elevates its tail over the back, showing the white under surface and giving the appearance of a white rump like an antelope's, whence the common name, "Antelope Squirrel," by which it seems to be almost universally known throughout its range. It has as many as eight young in a litter.

Genus CALLOSPERMOPHILUS (Grk. *kallos*, beautiful + *spermophilus*).

Callospermophilus Merriam, *Proc. Biol. Soc. Wash.*, xi., p.189 (1897). Type *C. lateralis*.

Ears fairly large; tail less than one half length of head and body; skull broad; interorbital space broad; nasals broad, longer than premaxillaries; dentition as in *Citellus*; first premolar small.

This genus of Ground Squirrels, somewhat closely resem-

bling the chipmunks in external appearance, though larger, is found in western North America, from about Lat. 55° southward through the United States into the State of Chihuahua, Mexico, and from the eastern foot-hills of the Rocky Mountains westward nearly or quite to the Pacific Coast. Nine species and subspecies are given in Elliot's Check-list, of which two are found in Colorado.

KEY OF THE SPECIES

A. Darker in color; black stripes prominent and pronounced.

C. *lateralis*, p. 166

B. Pale in color; dark stripes not very marked, hardly to be called black.

C. *wortmani*, p. 169

Callospermophilus lateralis (Lat., belonging to the side).

Say's Ground Squirrel. Big Chipmunk.

Sciurus lateralis Say, *Long's Exp. Rocky Mts.*, ii., p. 46 (1823).

Type locality.—The Arkansas River, about twenty-six miles below Cañon City, Colorado.

Measurements.—Total length, 11; tail vert., 3.5; hind foot, 1.65.

Description.—(From a specimen taken May 19th, near Sheephorn Pass, Grand County, Colorado): Back between stripes, nape, and top of head a mixture of black, grayish white, and rufous; inner pair of stripes black, not very well defined; light stripes yellowish rusty white, extending from shoulder to hip; outer dark stripe black, quite wide and well defined; flanks and sides of neck deep bright chestnut; upper surfaces of feet a pale yellowish rusty color; a light ring around eye; below, light rufous, black bases of hairs showing through; upper surface of tail mixed black and chestnut, and chestnut border; under surface chestnut, rather ill-defined black border, with chestnut outside that again. In worn winter and early spring pelages the colors are grayer, and the black stripes are often quite rusty. A July specimen has top of head chestnut.

Distribution.—This species is found through the mountainous parts of Colorado, New Mexico, and Arizona. In Colorado it occurs from the east base of the mountains westward, ranging down to a little below 6,000 feet elevation.

Habits.—A mountain animal, ranging from the foot-hills nearly to timber-line. A frequenter of rocks and bushy places, living in holes and burrows. Its food consists of

seeds and acorns. It comes around camps for any food which may be thrown out, and frequently becomes very tame, even taking food from the hand. The breeding season varies with altitude, and young are out of the holes from the middle of May until the middle of July. Four to six young are born in a litter. A family of six half-grown young were found at



FIG. 55. SAY'S GROUND SQUIRREL, *Callospermophilus lateralis*
From life, E. R. Warren, Photo.

Crested Butte, altitude 9,000 feet, July 8th, while at Yarmony Creek, altitude 6,800 feet, young of equal size were out May 23d. It is possible there may be two litters in a season, but there is no evidence to that effect.

The animal goes into hibernation in early October, re-appearing in early April. At Crested Butte it has been known

to burrow up through three feet of snow at that season to get out on the surface. An animal taken at that time was exceedingly fat. One was lately seen, November 8th, above Manitou, at 8,000 feet, and one was taken November 11th, at 6,700 feet in the foot-hills near Colorado Springs.

The capacity of the cheek pouches is something surprising. I took one with twenty-seven acorns from the scrub oak in its pouches. It is hardly necessary to say that its head appeared to be greatly swelled.

Mr. Harold Durand saw one, near Querida, enter a hole or crack in the bank of a gulch in which was a Mountain Bluebird's nest containing three young just about ready to fly. The old birds were greatly excited, and two of the young came out, and Mr. Durand found, on investigating, the third one dead, and freshly killed and still warm.

Another instance of flesh-eating which came to my own notice was in the case of a closely allied species (*C. cinerascens*) in the Yellowstone Park. This was a few years ago when two friends and myself were riding along one of the roads in the Park and saw the squirrel come up on a log carrying a young meadow mouse (*Microtus* sp.) in its mouth. Sitting upright on the log, and holding the mouse in its paws, the squirrel proceeded to eat the mouse, beginning at the head, and ate the head and part of the body while we watched it. As this was on the edge of a meadow the mouse had probably been caught in the grass.

No doubt these animals destroy quite a few eggs and young birds during the breeding season, and in this way may be considered harmful, while the destruction of such an animal as the meadow mouse may be called beneficial, though to be sure in such a place as the Yellowstone Park these mice do little or no damage.

Callospermophilus wortmani. Wortman's Ground Squirrel

Tamias wortmani Allen, *Bull. Am. Mus. N. H.*, vii., p. 335 (1895).

Type locality.—Kinney Ranch, Bitter Creek, Sweetwater County, Wyoming.

Measurements.—As in *lateralis*.

Description.—(From specimen in fresh pelage taken on Snake River, Routt County, June 21st): A paler animal than the preceding, but the pattern of coloration is exactly the same. The rufous and chestnut are much paler, while the inner black dorsal stripe is but faintly indicated, almost obsolete; the outer dark stripe is much less black; the light stripe is much whiter; the chestnut of the flanks, shoulders, and sides of neck, though bright, is of a much lighter shade; upper surfaces of feet paler, almost white; below, the animal is white in comparison with *lateralis*; in the upper surface of the tail the chestnut is a little more prominent, and below it is much paler.

Distribution.—At present Wortman's Ground Squirrel seems to be known only from the type locality, and from western Routt County, Colorado. In our State it is an inhabitant of the arid region of the Snake River Valley, where I took it on the west slope of Cross Mountain, about eight miles above Lily P. O., and also three miles farther up the Snake; I found it at Douglas Springs, in the Escalante Hills; Cary took specimens on the upper part of the Snake, near the Wyoming line.



FIG. 56. SAY'S GROUND SQUIRREL, *C. lateralis*, AND RELATED CHIPMUNK, *E. m. consobrinus*

Note difference in size and stripes. From life, E. R. Warren, Photo.

Habits.—These seem to be similar to those of *C. lateralis*, of which it is an arid land form, living among the sage brush and greasewood of that region. In its color and habitat it is a corresponding form to the Least Chipmunk, which also inhabits the same region, though the present species goes farther up among the pines than the latter does. It did not seem to be particularly common anywhere.

Genus EUTAMIAS (Grk. *eu*, well or good + *tamias*, a steward)

Eutamias Trouessart, *Cat. mamm. viv. et foss.*, p. 86 (1780).
Type *Tamias asiaticus*.

This genus contains the bulk of the chipmunks which are distinguished by possessing internal cheek pouches and a characteristic pattern of coloration consisting of a series of five dark and four light dorsal longitudinal stripes. The tail is rather shorter and less bushy than in the squirrels, and the ears never have tufts.

The skull is slender and light, and has very slender, backwardly directed postorbital processes, and an oval interorbital foramen, and the anterior premolar, if present, is small and functionless.

Dentition: i. $\frac{1}{1}$; pm. $\frac{1 \text{ OR } 2}{1}$; m. $\frac{3}{3} \times 2 = 22 \text{ or } 24$.

The species of this genus are found all over North America and northern Asia. In Elliot's Check-list 25 North American species are mentioned, of which 5 species and 3 subspecies inhabit Colorado.

KEY OF THE SPECIES

- A. Larger; total length over 8.25.
 - a. Grayish; dorsal stripes not distinct. **E. dorsalis utahensis**, p. 171
 - b. Stripes distinct; ground color of upper parts dull dark chestnut; dark stripes distinctly black in midsummer pelage.
 - E. quadrivittatus**, p. 173
 - c. Stripes distinct; color very pale, general tinge pale rusty rufous.
 - E. quadrivittatus animosus**, p. 174
 - d. Stripes distinct; ground color of upper parts light bright chestnut; dark dorsal stripes not black.
 - E. hopiensis**, p. 175

B. Smaller; length less than 8.25.

- a. Largest length, 7.75-8.25. Tail fringed with rufous-tipped hairs; light stripes distinct, outer dark stripe not very strong; tail bushiest of this section; hind foot, 1.25.

E. amoenus operarius, p. 176

- b. Small; length, 7.25-7.50. Hind foot, 1.14. Pale and bleached in color; tail not at all bushy, with rufous fringe.

E. minimus, p. 177

- c. Size as in *b*. Color dark; in midsummer pelage colors intense deep chestnut; dark stripes very black and broad, light stripes narrow; tail without rufous fringe. Winter pelage grayer.

E. minimus consobrinus, p. 179

- d. Size as in *b*. Color in winter pelage very gray, especially on sides and flanks; summer pelage similar to *E. minimus*, but less extensive rufous on sides, and with grayer flanks and shoulders.

E. minimus caryi, p. 180

Eutamias dorsalis utahensis (Lat. *dorsalis*, pertaining to the back; *utahensis*, of or from Utah).

Utah Chipmunk.

Eutamias dorsalis utahensis Merriam, *Proc. Biol. Soc. Wash.*, xi., p. 210 (1897).

Type locality.—Ogden, Utah (Vernon Bailey).

Measurements.—Total length, 8.75; tail vert., 3.5; hind foot, 1.3.

Description.—(From a specimen taken at Douglas Spring, Routt County, June 24th): General tone grayish above, dull mixed gray and rufous on rump; sides pale rufous or chestnut, as is also the upper surface of the foot; beneath yellowish white; stripes indistinct; median stripe blackish, inner dark pair grizzled, mixed blackish and rusty rufous, outer dark pair practically obsolete; inner pair of light stripes grayish white, quite wide; outer pair also grayish white, but narrow; indistinct grayish white post-auricular spot; posterior half of ear grayish white; light facial stripes whitish; a rusty stripe through eye; upper and lower facial stripes mixed blackish and rufous, the latter stripe rather indistinct; top of head mixed grayish and rusty; upper surface of tail blackish, fringed with white-tipped hairs; under surface rufous, bordered with blackish.

Distribution.—The Utah Chipmunk is found in Utah, eastern Nevada, northern Arizona, and northwestern Colorado, in the Upper Sonoran and Transition Zones. In Colorado it is found in the Escalante Hills, Routt County, ranging east of the Snake River to the west flank of Cross Mountain, and probably inhabiting most



FIG. 57. SKINS OF CHIPMUNKS

From top down. 1. *Eutamias dorsalis utahensis*. 2. *Eutamias quadrivittatus*. 3. *Eutamias amoenus operarius*. 4. *Eutamias hopiensis*. 5. *Eutamias minimus*. 6. *Eutamias minimus consobrinus*. 7. *Eutamias quadrivittatus animosus*

of that mountain. It will very likely be found in the Yampa Plateau south of the Bear River.

Habits.—This species is an inhabitant of the cedar and piñon zone, as observed in Routt County, extending a little up into the yellow pines, its range of altitude being from 6,000 to 7,000 feet. It seemed to prefer rocky ground, and was wild and shy in its behavior, rendering it difficult to obtain specimens by shooting.

It is easily distinguished from any other of our Colorado Chipmunks by its peculiar coloration, entirely different from that of the rest.

Eutamias quadrivittatus (Lat. *quadri*, four, + *vitta*, a band, = four-lined or banded).
Colorado Chipmunk.

Sciurus quadrivittatus Say, *Long's Exped. to Rocky Mts.*, ii., p. 45 (1823).

Type locality.—On the Arkansas River, about thirty miles below "the place where the river leaves the mountains" (Say, *l. c.*), or about twenty-six miles below Cañon City.

Measurements.—Total length, 8.5–9.5; tail vert., 3.75; hind foot, 1.35.

Description.—(From specimen collected at Wagon Wheel Gap, July 19, 1905): Median dark stripe black, extending forward between ears; inner pair of dark stripes black, edged with rufous, the latter color predominating on the anterior portion, and ending about an inch behind the ear; outer pair of dark stripes about half as long as inner, less distinct, black, with rufous edge; inner pair of light stripes grayish white, outer pair clearer white; sides, flanks, and upper portion of feet chestnut or rufous, mixed with blackish on shoulders and flanks; whitish gray behind ears; grayish white stripes above and below eyes; upper and middle dark facial stripes blackish, lower one rufous; top of head gray; under surface of body white, the hairs blackish at base; upper surface of tail mixed black and rufous, under surface rufous, black bordered.

In a December specimen taken at Colorado Springs the whole general tone of the upper parts is grayer, dark stripes with much less black and more rufous; light stripes grayer; sides and flanks duller; upper surface of tail more chestnut.

Distribution.—Elliot, in his Check-list, p. 172, gives the distribution of the Colorado Chipmunk as "State of Durango, Mexico, north to southern boundary of Colorado, northward through

Wyoming, to and including the Yellowstone National Park." There is but little information at hand concerning this, and I have my doubts as to the correctness of this statement.

This species has a wide range in Colorado, though apparently not very abundant at any one place. Throughout much of its range it is associated with either *E. amoenus operarius* or *E. minimus consobrinus*, and in either case these latter are usually the more abundant. It ranges from the western slope of the mountains to the eastern edge of the foot-hills, and even out into the plains region where there are tongues of timbered country extending into it. Grand Lake is at present the most northerly record for Colorado that I know of. Yarmony Creek, Eagle County; Wagon Wheel Gap, Mineral County; and Sapinero, Gunnison County, are the most western records. The species has been recorded from Grand, Eagle, Teller, Park, El Paso, Fremont, Chaffee, Custer, Saguache, Mineral, western Las Animas, and Gunnison counties. I do not think it ranges much above 9,000 feet elevation.

Habits.—The Colorado Chipmunk lives among the forests, and in the brushy places, preferring probably the latter and especially liking rocky ground. Its food consists of seeds of various kinds, acorns, seeds from pine and spruce trees, and very likely insects. While it hibernates in cold weather, it has been seen every month in the year in mild winters about Colorado Springs, as also has *E. operarius*. Each of three females taken in Grand County, May 10th–20th, contained 5 fetuses. This was at altitudes of from 8,200 to 8,500 feet.

Eutamias quadrivittatus animosus (Lat. spirited). Las Animas Chipmunk.

Eutamias quadrivittatus animosus Warren, *Proc. Biol. Soc. Wash.*, xx., pp. 105–106 (1909).

Type locality.—Irwin's Ranch, northeastern Las Animas County, Colorado; altitude 5,000 feet.

Measurements.—Type, total length, 9.75; tail vert., 4.50; hind foot, 1.45.

Description.—A very pale animal. Inner pair of light stripes grayish white, outer pair quite clear white; middle dark stripe

blackish, pale chestnut or rufous bordered; inner pair of dark stripes rather pale chestnut rufous, darkest posteriorly, with a little blackish; outer pair a pale shade of the same, not very distinct from the color of the sides, which are pale yellowish rufous; postauricular spot large and whitish; top of head and shoulders quite gray; dark facial stripes narrow and blackish, not clearly black; flanks grayish; upper surface of tail with less black and more rusty than in typical *quadrivittatus*; under surface of tail pale bright rufous, not the dark chestnut of *quadrivittatus*.

There are no cranial characters by which it may be distinguished from *quadrivittatus*.

Distribution.—At present this form is known only from the type locality, and from Gaume's Ranch, in the northeast corner of Baca County. Presumably it inhabits the region known locally as "The Cedars," a sandstone mesa country in the eastern part of Las Animas County, and the western edge of Baca County. This district is cut up into many shallow cañons and gulches, with rather an abundant growth of cedars (*Sabina scopulorum*), and some piñons. It is a very arid region, which fact most likely accounts for the pale colors of this animal.

Eutamias hopiensis (named for the Hopi Indians). Hopi Chipmunk.

Eutamias hopiensis Merriam, *Proc. Biol. Soc. Wash.*, xviii., p. 165 (1905).

Type locality.—Keam Cañon, Painted Desert Region, Arizona (A. K. Fisher).

Measurements.—Total length, 8.5; tail vert., 3.5; hind foot, 1.25.

Description.—(From a specimen taken at Grand Junction, Sept. 29th): General appearance of animal a lightish bright chestnut or rufous color; the median dark stripe is a dark shade of the same color, with middle part of the posterior portion black; inner pair of dark stripes similar, but lacking the black, or at most it is but faintly indicated; outer pair of dark stripes nearly obsolete, just a shade darker than the color of the flanks; inner pair of light stripes not very distinct, grayish white; outer pair much whiter and clearer; rump and flanks grayish; sides of body and upper surfaces of feet light bright rufous; a distinct, large white postauricular spot, and posterior half of ear whitish; light facial stripes quite white; dark ones rufous, the lower running distinctly around under ear; top of head mixed grayish and rusty, with some black hairs intermixed; below, grayish white; tail above, mixed black and chestnut; below bright chestnut, with indistinct black border.

A specimen taken at Coventry, Montrose County, Dec. 6th, is much grayer all over. One taken near Wolcott, Eagle County, July 22d, is darker than the September specimen, with more black in the middle dorsal stripe. The whole appearance of *hopiensis* is that of a lighter and brighter colored animal than *quadrivittatus*.

Distribution.—This species is found in northern Arizona, southern or southeastern Utah, and southwestern Colorado, and very possibly northwest New Mexico.

It is found through the cedar and piñon zone of western Colorado, ranging from Rio Blanco County south and west to the southern and western boundaries of the State, but not, at least so far as is now known, extending into the mountains. Its vertical range is probably little, if any, above 7,000 feet altitude. Yarmony Creek, Eagle County, is at present the most northeastern record. It has been taken in Montezuma, Montrose, Mesa, Delta, Rio Blanco, and Eagle counties.

Habits.—The general habits of the Hopi Chipmunk differ little, if any, from those of the other species. At Yarmony Creek, near the corner to Eagle, Grand, and Routt counties, half- and two-thirds-grown young were found May 22, 1907.

Eutamias amœnus operarius (Lat. *amœnus*, pleasant; *operari*, to work). Busy Chipmunk.

Eutamias amœnus operarius Merriam, *Proc. Biol. Soc. Wash.*, xviii., p. 164 (1905).

Type locality.—Gold Hill, Boulder County, Colorado (Vernon Bailey).

Measurements.—Total length, 8.00; tail vert., 3.5; hind foot, 1.25.

Description.—(From a Park County specimen, taken August 7th): Middle, and inner pair of dark stripes quite broad and black, with indistinct rufous borders; outer pair dark stripes less distinct, mixed black and rufous; light stripes broad, and grayish white, the outer pair being the whitest; sides light rufous; flanks gray; upper surfaces of feet light dull rufous; light facial stripes grayish white; dark ones blackish; large whitish post-auricular patch; below, rusty white; upper surface of tail mixed rusty and black; below, rufous, black bordered; the tail is much bushier than in *E. minimus* or *E. consobrinus*.

The seasonal changes of pelage do not seem to be very strongly marked, though the tone of the winter pelage is somewhat grayer. The skull is larger and more massive than in *minimus*, *consobrinus*, or *caryi*, and in case of doubt affords, in connection with the longer

hind foot, a good means of identification. Its smaller size, and proportionately longer tail serve to distinguish it from *quadrivittatus* which is the one of the larger chipmunks that it most resembles.

Distribution.—This Chipmunk is found principally east of the Continental Divide, ranging from the foot-hills to and above timber-line, and also being found west of the Divide in Grand, Summit, Hinsdale, and San Juan counties; Elkhorn and Livermore, Larimer County, are the most northern records; Silverton, San Juan County, is the most southwestern; and Fisher's Peak, Las Animas County, is the most southeastern. It has been reported from the following counties in the State: Larimer, Grand, Boulder, Jefferson, Clear Creek, Arapahoe, El Paso, Teller, Park, Summit, Lake, Eagle, Chaffee, Las Animas, Hinsdale, and San Juan.

I know of no records of its occurrence outside the State of Colorado.

Habits.—The Busy Chipmunk is found in various kinds of country throughout its range, in the pine and spruce forests, in the brush along streams, among rocks and fallen timber, in fact in almost any place except entirely open ground.

A specimen taken near Colorado Springs, May 11th, contained five good-sized fœtuses. On Boreas Pass, August 1st, at 11,000 feet, two-thirds-grown young were taken.

Eutamias minimus (Lat., least). Least Chipmunk

Eutamias minimus Bachman, *Jour. Acad. Nat. Sci. Phila.*, p. 71 (1839).

Type locality.—Green River, southwestern Wyoming.

Measurements.—Total length, 7.5; tail vert., 3.35; hind foot, 1.14.

Description.—(From a specimen taken on the Snake River, Routt County, June 21st): A pale faded-looking animal, the palest, except *caryi*, of the seven Colorado Chipmunks having prominent stripes. But the darker stripes are quite black, edged with rufous, the outer pair extending well forward, and with not as much black as the others; inner pair of light stripes grayish, outer pair much whiter; a distinct whitish postauricular spot; greater portion of ear grayish; top of head distinctly gray; facial stripes not very marked, light ones whitish, dark ones pale rufous, with a little

black intermixed; sides of body pale rufous, flanks gray; upper surfaces of feet quite gray; below white; upper surface of tail grayish and black; under surface rufous, with black border and tip; the tail is rather thin and scanty.

The skull is comparatively small and slender. The short hind foot is a very good character in separating this and the succeeding subspecies from *E. operarius*.

Distribution.—The Least Chipmunk is found in Wyoming, northwestern Colorado, and northeastern Utah. The typical form is confined in Colorado to the northwestern corner of the State, its eastern limit being roughly about twenty miles east of the Snake River, in Routt County, and its southern, by the Bear River at Sand Creek and Lily.

Outside of these limits to the south and east it begins to merge into the next form, becoming gradually darker and more brightly colored.

Habits.—The Least Chipmunk is an inhabitant of the arid portions of western Colorado, living amongst the sagebrush and greasewood of the dry plains of that part of the State, and seemingly not extending much into the cedar and piñon zones. It is usually quite a shy, restless little animal, but sometimes becomes very tame and bold about camps, and is then rather a nuisance, stealing all kinds of eatables which it may be able to carry away. This, however, is not peculiar to this species, for all the chipmunks become thus familiar when not molested, and will sometimes become so tame as to take food from one's hand. At one camp in Gunnison County I once had two or three feeding from my hand, and several others picking up crumbs about my feet, all at the same time. In these cases it is very interesting to watch them, and observe their habits. Much of the food they pick up is placed in their cheek pouches and carried away, presumably to their holes and store-rooms, for winter use. For it is not unlikely that they are more or less active in their burrows during winter, even when they do not come outside.

Eutamias minimus consobrinus (Lat. related).

Related Chipmunk.

Tamias minimus consobrinus Allen, *Bull. Am. Mus. Nat. Hist.*, p. 112 (1890).

Type locality.—Wahsatch foot-hills, near Salt Lake City, Utah.

Measurements.—As in *E. minimus*.

Description.—(From a specimen taken in Eagle County, July 23d): A very much darker-colored animal than the preceding; in midsummer pelage almost black-looking; the dark dorsal stripes are very black, with a faint edging of bright chestnut, and fairly wide; the inner light stripes narrow, quite a dark gray, the outer a much lighter gray, nearer white; sides of body deep, bright rufous; flanks dark gray; upper surfaces of feet pale rufous or rusty; top of head black with gray and rufous hairs intermixed; dark facial stripes rather black; light stripes grayish, not very distinct; post-auricular spot grayish white; below grayish white; tail above, black, with some rufous intermixed; below, rufous with black border; the tail is thin as in *E. minimus*. In winter pelage the animal is grayer, and the colors are not so intense.

Distribution.—The Related Chipmunk is found in eastern Utah, from the eastern border of the Great Basin eastward; in western Colorado; and possibly in northwestern New Mexico.

This species is the small chipmunk of the greater portion of western Colorado, ranging from the mountains down to the cedar and piñon zone, where it overlaps the range of the Hopi Chipmunk. Though confined principally to the region west of the Continental Divide, it is found in the North Park, on the Atlantic Slope, here overlapping, as also at one or two points in Grand County, the range of *operarius*. Thus far it has not been reported from east of the La Plata Mountains in the San Juan region, its place east of these mountains being taken by *E. operarius*, which is reported from Silverton and Lake City. It goes, in Montezuma County, nearly, if not quite, to the southern border of the State; it has been taken at Coventry, Montrose County, 6,800 feet altitude. Here the Hopi Chipmunk is very common. In Grand County it has been found in company with *E. quadrivittatus*, and at Yarmony Creek, Eagle County, *consobrinus*, *quadrivittatus*, and *hopiensis* were all found and taken, one each of the first two species, while the last named was very common. This occurrence is especially interesting from the fact that the locality is the most northwestern record for the Colorado Chipmunk, and the most northeastern for the Hopi. The species has been recorded from Larimer, Grand, Routt,

Eagle, Rio Blanco, Gunnison, Garfield, Montrose, and Montezuma counties.

Habits.—Not different from those of the other chipmunks. As shown by the examination of pregnant females the



FIG. 58. RELATED CHIPMUNK, *Eutamias m. consobrinus*
From life. E. R. Warren, Photo.

number of young in a litter is from four to six, and the breeding season is May and June, no doubt depending somewhat on locality and elevation.

Eutamias minimus caryi (named for Merritt Cary, who collected the type specimens).

Eutamias minimus caryi Merriam, *Proc. Biol. Soc. Wash.*, xxi., pp. 143-144 (1908).

Type locality.—Medano Ranch, San Luis Valley, Costilla County, Colorado (15 miles northeast of Mosca).

Measurements.—Average of ten specimens from the type locality (Merriam, *l. c.*): Total length, 7.63; tail vert., 3.4; hind foot, 1.15.

Description.—(From a topotype taken Oct. 29, 1907): A very pale animal; in winter pelage the neck, rump, and flanks are a pale clear gray, as also the inner pair of light stripes, while the outer pair are white, clearer than in either *minimus* or *consobrinus*; the dark stripes have less of a chestnut border than in those species; the sides are somewhat rusty; the head is gray with a rusty tinge; postauricular spots white, and fairly prominent; front of fore legs

and back of hind legs gray; tail much as in *minimus* but paler. This pelage is retained by the breeding females at least until July 1st. In summer pelage, as shown by males taken late in June, it is similar to *E. minimus* above, but the rufous of the sides is paler, and not quite as extensive, while the flanks, shoulders, and neck are much grayer, and the top of the head appears to be somewhat darker than that of specimens of *minimus* taken at the same season.

Distribution.—In a recent visit to the San Luis Valley I first saw this species just south of Moffat, and thence to Mosca it was seen more or less frequently. Farther south than Mosca I did not go. It was taken at San Luis Lake, and the Medano Ranch, the latter place being the type locality. I saw it on the east side of the San Luis Valley, between the Durkee Ranch and Mosca Creek, and thought I saw it at the latter place in the sandy country bordering the foot-hills there. I also saw it near Crestone, Saguache County. The limits of its range are not yet known.

Habits.—Cary's Chipmunk was found in the greasewood and rabbit-brush of that part of the San Luis Valley visited by me. I found it to be a very wild and shy species and very difficult to collect by shooting, for they seemed to run at the first sight of a person, and dodged in and out amongst the brush so that one could hardly get sight of them. Half-grown young were taken at Mosca, June 18th, and the females seemed to be nursing nearly, if not quite, to July 1st.

Genus SCIURUS (Lat., a squirrel, literally shade-tailed)

Sciurus Linn., *Syst. Nat.*, 10th ed., p. 63 (1758). Type *S. vulgaris*.

The members of this genus, the true squirrels, are distinguished by their long, broad, and bushy tails, their pointed and often tufted ears, and their feet which are adapted for climbing, the anterior with four digits and a rudimentary pollex, the posterior with five, all with claws; postorbital processes well developed; dentition, i. $\frac{1}{1}$; pm. $\frac{1 \text{ or } 2}{1}$; m. $\frac{3}{3} \times 2 = 22$; upper anterior upper premolar when present small.

Squirrels are found throughout the temperate and tropical regions of the whole world except in Australia and Madagascar and the genus being a very large one has recently been

split up into a number of subgenera. In Elliot's Check-list 38 species of North American squirrels are recognized, apart

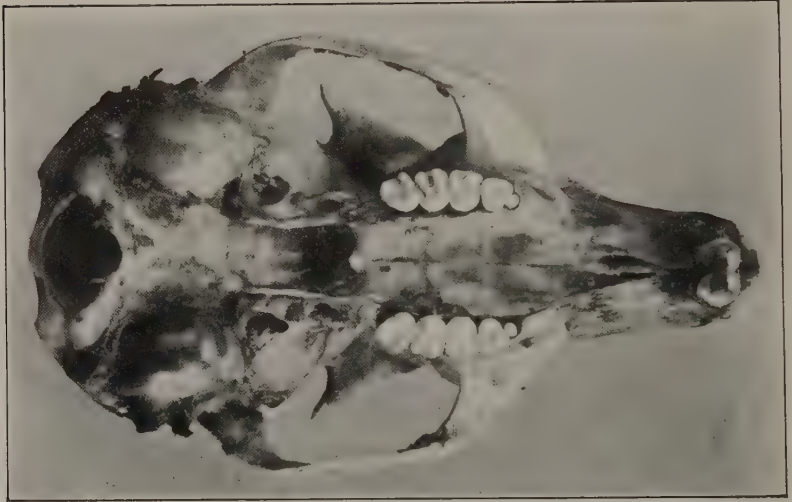


FIG. 59. ♀ PLAIN-BACKED SQUIRREL, *Sciurus aberti concolor*
Skull showing dentition x 1¹⁰/₁₆

from subspecies, but so far only two, including two subspecies, have been recorded from within our limits.

KEY OF THE SPECIES

- A. Larger, head and body about 12 ins.; ears long and tufted about 1 inch; color above gray, with black or brown color phases.
 - a. With a broad dorsal stripe of chestnut, *S. aberti*, p. 183
 - b. Paler, red dorsal area nearly obsolete, *S. a. mimus*, p. 183
 - c. Without the chestnut stripe, plain gray, *S. a. ferreus*, p. 184
- B. Smaller, head and body about 8 ins.; ears short, about 0.5 in., not tufted; color grayish on sides, rusty brown above.
 - S. fremonti*, p. 185

Sciurus aberti (for Col. J. J. Abert). Abert's Squirrel

Sciurus dorsalis Woodhouse (*nec* Gray), *Proc. Acad. Nat. Sci. Phila.*, p. 110 (1852).

Sciurus aberti Woodhouse, *Proc. Acad. Nat. Sci. Phila.*, p. 220 (1852).

Type locality.—San Francisco Mountains, Arizona (Woodhouse).

Measurements.—Total length, 20.2; tail vert., 8.9; hind foot, 2.5–2.75.

Description.—(From Mearns): Color plumbeous-gray above, with a broad dorsal area of reddish brown; under surfaces, including the tail, pure white; sides of the body with a black line separating the gray of the upper surface from the white of the under surface; tail black at tip, mixed gray and black above, and white beneath. Ears long and pointed; in winter with chestnut hair at base, and blackish ear tufts more than an inch in length.

Distribution.—Abert's Squirrel is found in the pine-covered plateaus and mountains of northeastern Arizona, and ranging east into New Mexico. C. P. Rowley collected some squirrels at Florida, La Plata County, Colorado, which were assigned by Dr. J. A. Allen to this form, but were the next described subspecies, which had not been described at the time Dr. Allen's paper was published, and which has since been taken in the San Juan Mountains a little to the eastward of Florida. Dr. Allen has kindly looked up the specimens, and reports they are *S. a. mimus*, and the probability is that typical *aberti* does not occur in Colorado.

Habits.—See under *S. a. ferreus*.

Sciurus aberti mimus (Lat. *mimus*, a mimic).

Mimic Squirrel.

Sciurus aberti mimus Merriam, *Proc. Biol. Soc. Wash.*, xvii., p. 130 (1904).

Type locality.—Hall Peak, at south end of Cimarron Mountains, northeastern New Mexico (C. M. Barber).

Measurements.—Total length, 19.1; tail vert., 8.5; hind foot, 2.75.

Description.—"Similar to *S. aberti*, but gray of upper parts decidedly paler; dorsal area usually obsolete or nearly so; upper side of tail paler; ear tufts pale fulvous, grizzled and tipped with black (instead of mainly black); tail apparently shorter." Merriam, *l. c.*

Distribution.—Besides the type locality in northeastern New Mexico, the Mimic Squirrel has been reported from the eastern foot-hills of the San Juan Mountains, 10 miles west of Antonito,

Conejos County, Colorado, and has also been found on the west slope of the same mountains; the record of *S. aberti* from Florida, La Plata County, is, as stated under that species, referable to *S. minimus*. As the type locality of the present form is in northeastern New Mexico, it would seem as if it would be the race inhabiting southern Colorado, to the exclusion of true *aberti*. Its northern range is undetermined; like the next form it is no doubt very locally distributed.

Sciurus aberti ferreus (Lat. *ferreus*, of or made of iron and also used to denote the color of iron, *i. e.*, metallic or iron gray). Plain-Backed Squirrel.

Sciurus aberti concolor True, *Proc. U. S. Nat. Mus.*, xvii., p. 241 (1894).

Sciurus aberti ferreus True, *Proc. Biol. Soc. Wash.*, xiii., p. 183 (1900).

Type locality.—Loveland, Larimer County, Colorado (William G. Smith).

Measurements.—Total length, 19.3; tail vert., 8.3; hind foot, 2.3; ear, 0.85.

Description.—Upper parts gray, lacking the chestnut or reddish patch; under surfaces white; upper side of feet gray, toes white; ears gray with lengthened tufts, black mixed with gray and chestnut; tail alike above and below, gray bordered with black, and fringed with white. This race, and very possibly the two preceding, though there is no mention of it in the literature at hand, has two color phases besides the one just described; in one the animal is a uniform dark brown; and in the other it is black all over. In many places these two colors are greatly in the majority; on the Divide north of Colorado Springs Mr. C. E. Aiken says that only ten per cent. of the squirrels are gray, and of the remainder two thirds are black and one third brown; this estimate is based on the skins brought to him for sale.

Distribution.—The Plain-backed Squirrel is found along the foot-hill districts of eastern Colorado, ranging from 7,000 to 8,000 feet, chiefly in the yellow pine zone, but it is very irregularly and locally distributed. It ranges at least as far north as Fort Collins; it is found in some parts, at least, of the Platte Cañon region, and on the Divide, north of Colorado Springs; I have heard of it near Salida, but it is very rare there.

Habits.—The various forms of Abert's Squirrel are con-

finer quite closely to the yellow pine timber, and are of similar habits. They build nests of pine boughs and twigs in the branches of the trees, lined with grass. According to examinations made by Dr. Mearns of pregnant females, the number of young at a birth is from 3 to 4; they breed in spring or early summer. The food consists largely of the seeds of the pines, which they extract from the cones, and the spots where a squirrel has been feeding are easily located by the chips and cores of the cones.

The ear tufts are shed in the spring, and the new ones do not attain their full growth until early winter, hence summer-caught specimens have the ears nearly or quite tuftless. A specimen taken by me near Colorado Springs, May 14th, has nearly full ear tufts, but the body pelage has nearly all been shed, except on the rump, and the new hair is just beginning to grow. This was a gray specimen.

Sciurus fremonti (for Gen. John C. Fremont, whose expedition collected the type). Fremont's Chickaree or Squirrel. Pine Squirrel.

Sciurus fremonti Aud. and Bach., *Quad. N. Amer.*, iii., p. 237 (1853).

Type locality.—"Rocky Mountains," probably in the South Park, in Colorado.

Measurements.—Total length, 13; tail vert., 5; hind foot, 2.

Description.—Color of back mixed gray and rusty, these colors being on the tips of the hairs, which are blackish at the base; beneath lighter, almost white in summer, grayer in winter. In summer pelage there is a distinct black lateral line, bordered above by rufous, and this latter is the color of the upper surfaces of the feet; top of head quite dark in summer. In winter pelage the lateral line is entirely or practically absent, as also the rufous of the sides and feet. Tail dark above and below, with fringe of white-tipped hairs.

Distribution.—This squirrel is found in the mountains of Colorado, and in the Uintah Mountains of Utah, while to the south in New Mexico and Arizona it is replaced by several closely allied

subspecies, one of which, *S. fremonti neomexicanus*, may possibly range into southern Colorado.

Habits.—Fremont's Squirrel is more or less common in the spruce and pine zones of Colorado, all through the mountainous parts of the State. About Colorado Springs it has a vertical range from a trifle over 6,000 to above 11,000 feet. Its food is largely the cones of the pines and spruces amongst which it lives, and, like Abert's Squirrel, it leaves heaps of the debris of the cones at its feeding places. It stores cones to some extent in the fall, by hiding them in holes in the ground and elsewhere.



FIG. 60. FREMONT'S SQUIRREL, *Sciurus fremonti*, "CHARLIE"
From life, E. R. Warren, Photo.

Its nests are built in the trees, of twigs and grass and moss, and I think it also to some extent uses underground habitations. The breeding season is in the spring, and about four young form a litter. They are born the last of May and early in June.

These squirrels will sometimes become very tame when

not molested. The one whose picture is shown here lived near the mine of a friend, and had become so tame as to take nuts from one's hand. These were usually peanuts, and when he had eaten his fill would carry away others that might be given him to some hiding place; he seemed to know the name by which he had been christened, "Charlie," very well, and would come when called, if within hearing. At one time he had a mate who was so unfortunate as to be caught in a trap set for a mountain rat; he found her before the people did, and attracted their attention by his chattering. They said his grief was pitiful to witness, that he caressed and fondled the body as if trying to coax her back to life in a manner almost human.

ORDER CARNIVORA

This order contains a large assemblage of highly organized and powerful animals chiefly flesh-eating in diet, such as cats, dogs, weasels, and seals. They are distinguished by possessing five or sometimes four digits, usually armed with more or less sharp-pointed claws, by the pollex and hallux not being opposable to the other digits, and by their teeth, of which there are two sets, each divided into incisors, canines, and molars, all of which are rooted. Other characters are: Incisors small and pointed, usually three pairs above and below, of these the median pair are the smallest; canines strong, conical, and well developed; molars usually compressed, sharp-edged, and adapted for cutting; condyle of the lower jaw on a level with the molars and working in a transverse semicircular groove, the glenoid cavity, restricting all lateral motion; clavicles rudimentary or absent; radius and ulna distinct; no centrale; cerebral hemispheres always convoluted to a certain extent; stomach simple; cœca small or absent; uterus bicornate: placenta discoidal and generally zonary.

This order is divided into two suborders for the terrestrial and marine forms respectively, and comprises altogether eleven families. Only four of these are represented in the Colorado fauna, the marine forms naturally being absent, as well as the Civets (*Viverridæ*), the Aard Wolf (*Protelidæ*), and the Hyenas (*Hyænidæ*), all of which are confined to the Old World.

KEY OF THE FAMILIES

- A. Plantigrade or semi-plantigrade; five toes to both limbs; claws non-retractile.
 - a. Plantigrade to nearly digitigrade; tail never annulated; molars $\frac{1}{2}$. **Mustelidæ**, p. 188
 - b. Plantigrade or semi-plantigrade; tail moderate or long, annulated; molars $\frac{3}{2}$. **Procyonidæ**, p. 218
 - c. Plantigrade with naked soles; tail very short, almost rudimentary; molars $\frac{3}{2}$. **Ursidæ**, p. 222
- B. Digitigrade; complete toes, 4 on fore limbs, 5 on hind; claws blunt and non-retractile. **Canidæ**, p. 233
- C. Digitigrade; toes, 5 on fore limbs, 4 on hind; claws curved, sharp, and retractile. **Felidæ**, p. 251

Family MUSTELIDÆ

This family contains the Otters, Weasels, Badgers, and Skunks, and cannot be easily characterized by external characters. Both limbs with five toes and with flat nails or non-retractile claws; skull with the auditory bullæ depressed, uninflated, and undivided as in the *Ursidæ* but with no alisphenoid canal; post-glenoid process considerably produced and curved round the glenoid fossa so as to hold the condyle of the lower jaw very tightly and prevent the mandible being easily pulled away from the cranium; dentition with molars $\frac{1}{1 \text{ or } 2}$; the inner tubercular portion of the single upper molar always longer in an antero-posterior direction than the cutting external portion.

KEY TO SUBFAMILIES AND GENERA

- A. Feet short and rounded; toes fully webbed; habits aquatic (*Lutrinæ*). **Lutra**, p. 189

- B. Toes short, partially webbed; claws short, curved, and often semi-retractile (*Mustelinæ*).
- a. Form slender; digitigrade.
 - a'. Premolars 3 above and below.
 - a". Toes not webbed, soles hairy. **Putorius**, p. 192
 - b". Toes webbed, soles naked. **Lutreola**, p. 198
 - b'. Premolars 4 above and below; tail long and bushy, more than $\frac{1}{4}$ total length. **Mustela**, p. 200
 - b. Form stout; plantigrade; tail less than $\frac{1}{4}$ total length, bushy; 4 premolars above and below. **Gulo**, p. 203
- C. Toes long and straight, not webbed; claws straight or very slightly curved, those of fore feet elongated (*Melinæ*).
- a. Body elongated, form more slender than in *b*; tail well over $\frac{1}{4}$ total length and bushy.
 - a'. Color pattern with four interrupted white lateral stripes on black ground. **Spilogale**, p. 212
 - b'. Color pattern two white lateral stripes on black. **Mephitis**, p. 208
 - b. Form stout; tail short, less than $\frac{1}{4}$ total length; no special color pattern. **Taxidea**, p. 205

Subfamily LUTRINÆ

Carnivora of aquatic habits with short, broad, and depressed heads; small ears; short and rounded feet, with the toes webbed and the claws small, curved, and blunt; kidneys conglomerate.

Genus LUTRA (Lat., an otter)

Lutra Brisson, *Regn. Anim.*, 2d. ed., p. 201 (1762). Type *Mustela lutra* Linnæus.

Revision, Rhoads, *Trans. Amer. Philos. Soc.*, N. S., xix., pp. 417-439 (1898).

Body long and slender; tail long; legs short; soles and palms hairy; outline of skull above flat; rostrum short; postorbitals well developed; a pronounced postorbital constriction; hinder portion of skull wide; dentition: i. $\frac{3}{5}$; c. $\frac{1}{4}$; pm. $\frac{4}{8}$; m. $\frac{1}{2} \times 2 = 36$; upper molar large, quadrate; first upper premolar very small; upper carnassial with tricuspid blade and large inner lobe.

The members of this genus are of exclusively aquatic habits, living principally if not entirely on fish which they catch by diving and swimming. It is practically a cosmo-

politan genus absent from Australia only. Elliot's Checklist gives 4 species and 4 subspecies as inhabiting North and Middle America, with one form found in Colorado.

Lutra canadensis. Canadian Otter

Lutra canadensis sonora. Sonoran Otter

Mustela lutra canadensis Schreber, *Saüght.*, 1776, pl. cxxvi. B; Text 1778.

Type locality.—Eastern Canada.

Lutra canadensis sonora Rhoads, *Trans. Amer. Philos. Soc.*, N. S., xix., p. 431 (1898).

Type locality.—Montezuma Well, Beaver Creek, Yavapai Co., Arizona.

It is impossible to say at present which form is represented in this State.

Measurements.—Total length, 45; tail vert., 14; hind foot, 4.5.

Description.—(From a Colorado specimen): Dark brown above, including tail; hairs on back gray-tipped for $\frac{1}{8}$ to $\frac{1}{4}$ inch, giving a silvery appearance; under fur thick and brown; belly brown, lighter than back and somewhat grayish; upper lip, chin, and throat gray, with a very slight yellowish cast; legs and feet brown.

Distribution.—The otter, in one form or another, is distributed all over the North American continent from nearly to the Arctic Ocean south into Mexico. It is very rare in Colorado, and we have but few records of its occurrence in this State; it is reported from Grand Junction, Greeley, Julesburg, and from the Grand and Bear rivers; the skin from which the description was taken is supposed to have come from somewhere on the headwaters of the Arkansas.

Habits.—Otters, being animals of aquatic habits, are seldom or never found far away from water, except sometimes when migrating from one stream or watershed to another. Their food is almost exclusively fish, which they catch in the water, diving and swimming after them. The young are from three to five in number, born in early summer, the den being in a suitable hole or cave under the bank. Thanks to their fine fur otters are much trapped and their numbers much lessened for this reason; but this does not explain their scarcity in Colorado, where they appear to have always been rare.



FIG. 61. SKULLS OF WEASELS, ETC.

1. *Mustela caurina origenes*. 2. *Lutreola vison energumenos*.
3. *Putorius nigripes*. 4. *Putorius longicauda*. 5. *Putorius arizonensis*. 6. *Putorius streator leptus*.

All slightly reduced

Subfamily MUSTELINÆ

Terrestrial and often arboreal carnivora with an elongated body and short limbs, the toes of which are short and partially webbed; claws short, compressed, acute, curved, and often semi-retractile; kidneys simple.

Genus PUTORIUS (Lat. *putor*, a stench, in allusion to the offensive fluid secreted by the animals).

Putorius Frisch, *Nat. Syst. vierfüss. Thiere*, in Tab. II., Tab. Gen. (1775). Type *Mustela putorius* Linnæus.

Revision, Bangs, *Proc. Biol. Soc. Wash.*, x., pp. 1-24 (1896). Merriam, *N. A. Fauna*, No. 11 (1896).

Medium to small slender-bodied animals; legs short; tail long, not bushy; ears large; soles haired; rostrum short; bullæ flat; lambdoidal crests medium; sagittal crest small; dentition, i. $\frac{3}{8}$; c. $\frac{1}{4}$; pm. $\frac{3}{8}$; m. $\frac{1}{2} \times 2 = 34$. Females smaller than males.

This genus is found in the northern hemispheres of both continents, also extending into South America. They are among the most bloodthirsty mammals known—perhaps, their size considered, the most so. One species, *P. rixosus*, of North America, is the smallest carnivorous mammal known. While terrestrial mammals, most of the species can and do climb trees in search of or pursuit of prey. Their food consists of mammals of various sizes, from rabbits and prairie-dogs down, birds and their eggs, and very likely occasionally reptiles and frogs. They at times—that is, the larger species—attack poultry, and then often kill several fowl at one raid, apparently for the mere love of killing. Most of those species which live in cold climates have a winter and a summer coat of different colors, the former being white, usually with a black tip to the tail, and the latter of some shade of brown above.

Elliot's Check-list gives as found in North and Middle America 20 species and 14 subspecies of this genus, of which four have been met with in Colorado.

The members of this genus, in common with most of the

genera of the family, are subject at times to a parasite which locates in the sinus of the frontal and may cause much distortion of that part of the skull, and thus mislead the student if he happens to fail to notice the cause.

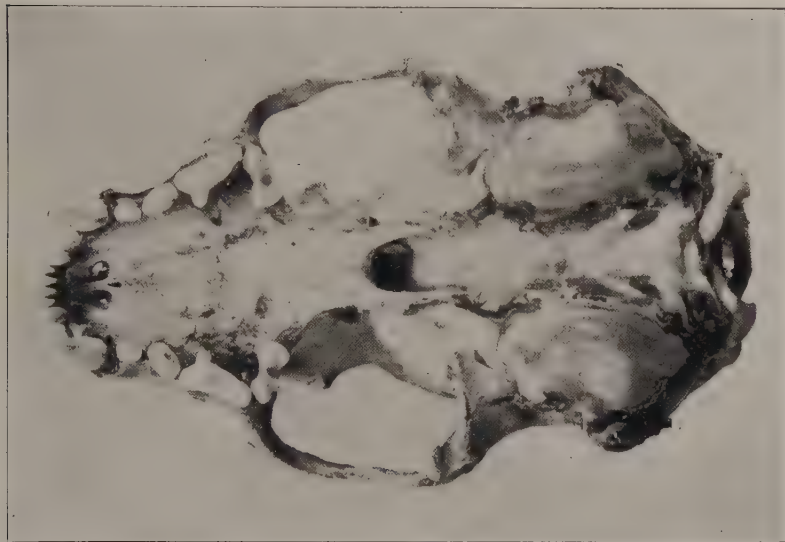


FIG. 62. BLACK-FOOTED FERRET, *Putorius nigripes*
Skull showing dentition $\times 1\frac{1}{2}$

KEY OF THE SPECIES

- A. Size large, length of adult male, 19.5; body rather heavy for a weasel; does not turn white in winter; color buffy, feet and band across face black; skull large and massive, with prominent postorbital process and pronounced postorbital constriction. *P. nigripes*, p. 194.
- B. Size medium; turn white in winter.
 - a. Larger, total length of males, 17.75, of females, 15.25; color in summer light brown above; postorbital constriction very marked in adult animals. *P. longicauda*, p. 195.
 - b. Smaller, total length of males, 16 or less, of females, 14; color in summer dark brown above; postorbital constriction not so great as in preceding; but still well marked. *P. arizonensis*, p. 196.
- C. Size small, total length, 9.5; turns white in winter. *P. streatori leptus*, p. 197.

Putorius nigripes (Lat. *niger*, black + *pes*, foot).

Black-Footed Ferret.

Putorius nigripes Aud. and Bach., *Quad. N. Am.*, ii., pp. 297-299, pl. 93 (1851).

Type locality.—Plains of the Platte River, Nebraska.

Measurements.—Male: total length, 19.35; tail vert., 4; hind foot, 2.5. Female: total length, 18; tail vert., 3.6; hind foot, 2.25. These are from Colorado specimens.

Description.—The color is a rather light buffy, with a dark area in the middle of the back; the under parts are a somewhat lighter shade of buffy; tail colored like body with black tip; a black band across face, which takes in eyes; both front and hind feet black, with part of the legs.

The skull is large and massive, broad between orbits, postorbital process well developed, and the postorbital constriction great; zygomata widely spreading; auditory bullæ quite large, flattened obliquely on outer side.

The size, color, and peculiar markings at once distinguish this animal from any other Colorado weasel.

Distribution.—The Black-footed Ferret is found on the plains from western North Dakota and northern Montana south to Texas. In Colorado it is found on the plains east of the mountains, and has also been taken west of the Pike's Peak Range, at Divide, Teller County, 9,200 feet elevation. One was also found dead in Lake Moraine, El Paso County, 10,250 feet elevation, but it is not known how it came to be there. The lake is surrounded by hills and mountains, with much timber. Divide, however, is open country, with prairie-dog towns all about. The animal has also been reported from the South Park. A. H. Felger has recorded, in *University of Colorado Studies*, Vol. VII., two mounted specimens in the collection of R. S. Ball, Meeker, and which were taken within a mile of that place. This is the first definite record I have from west of the Continental Divide in Colorado. Mr. Felger has kindly given me advance information as to this. The University of Colorado has in its collection one taken on the Laramie River, twelve miles south of the Wyoming line. I am indebted to Junius Henderson for this note.

Habits.—This species is found mostly about prairie-dog towns, where it feeds to a great extent on the inhabitants, being able to easily follow them anywhere in their holes. They also eat any other small animals they may find, and no

doubt catch a few small birds. As they seldom, if ever, come about habitations to destroy poultry, these ferrets are really of considerable benefit to man. They are, however, seldom abundant in any locality. We know little about their breeding habits; one man told me that the most he had ever seen were nine; this seemed to have been a family, either one adult and eight young, or two adults and seven young. This species has the curious history of having been lost to science for many years, as after its description by Audubon and Bachman no more specimens were seen by naturalists until a few years ago, and many doubts were raised as to whether such an animal actually existed.

Putorius longicauda (Lat. *longus*, long + *cauda*, tail).

Long-Tailed Weasel.

Mustela longicauda Bonaparte, *Charlesworth's Mag. Nat. Hist.*, ii., p. 38 (1838).

Type locality.—Carlton House, on North Saskatchewan River, Saskatchewan, Canada.

Measurements.—Of male: Total length, 17.75; tail vert., 6.75; hind foot, 2.0. Female, total length, 15.25; tail vert., 5.75; hind foot, 1.75.

Description.—(From a specimen taken at Lay, Routt County, June 17th): Summer pelage: Upper parts a rather pale clear brown somewhat darker on head; tail above and below like body, with black tip; chin white; under parts light buffy yellow, with a slight orange tinge; this color is also on upper side of fore feet, inner side of hind feet, and upper side of hind toes; soles of hind feet brownish.

The winter pelage is pure white all over, with black tip to tail. According to Bangs, there is no yellowish tinge to the winter coat; I have seen no winter specimens, but think it not unlikely there may be a yellowish tinge to the under parts in winter in some specimens.

The skull is large and broad, with well developed postorbital processes, and a very pronounced postorbital constriction. The brain case has a markedly triangular shape. The sagittal and lambdoidal crests are quite well developed. Zygomata spread quite widely and highly arched. Bullæ large, rounded, and about twice as long as wide.

Distribution.—The Long-tailed Weasel is found on the great plains from North Latitude 54° south to Kansas and Colorado, and also ranging to some extent at least west of the Rocky Mountains. In Colorado it is quite widely distributed apparently, though we have not very many records at present; it has been taken at Greeley, Lay, Littleton, and Wray.

Habits.—All the weasels are similar in appearance and habits; slender-bodied, bloodthirsty animals, destructive to animal life within their capacity to kill, and often killing for the mere lust of blood. The larger species kill animals as large as rabbits, and birds as large as grouse, and domestic poultry, though anything from a mouse up is meat for them. The slender body enables the creature to enter very small holes and reach the owners, and to investigate thoroughly every nook and crevice among fallen logs, or in rock slides. The breeding season is in the early summer, and large litters are the rule, six to eight or more. The families stay together until the young are quite good-sized, when they begin to shift for themselves. A weasel about a house or cabin makes the best of mousers, soon ridding the place of these pests.

A weasel is a savage, bold little animal, and often, when met, does not seem disposed to give the right of way to a man, stopping and looking about, before reluctantly turning to one side. The white winter coat of our species furnishes an inferior quality of ermine.

***Putorius arizonensis* (of or from Arizona).**

Mountain Weasel.

Putorius arizonensis Mearns, *Bull. Am. Mus. Nat. Hist.*, iii., No. 2, pp. 234-235 (1891).

Type locality.—San Francisco Forest, Arizona (a few miles south of Flagstaff).

Measurements.—Of male: Total length, 15.75; tail vert., 5.9; hind foot, 1.65. Female: total length, 14.0; tail vert., 5.1; hind foot, 1.6.

Description.—Summer pelage (from a specimen taken at Sapinero, Gunnison County, Colorado, May 20th): Upper parts

clear dark brown, decidedly darker on head; tail the same, somewhat lighter beneath, and with black tip; upper lip and chin white; rest of under parts buff with a decided orange tint; upper surface of front feet and hind toes, and inner side hind legs yellow; soles of hind feet pale brown. According to Merriam the color of the under parts varies quite considerably in depth and shade.

The winter pelage is white with black tip to tail. Many specimens show a yellow tinge on the under parts, and a January specimen from Salida is decidedly yellow underneath and on the flanks, and the tail has a strong brownish yellow suffusion.

In spring and autumn specimens are found showing the various stages of transition between the two pelages and are often very interesting.

The skull is proportionally smaller than that of *P. longicauda*, and the brain case decidedly less triangular, owing to the postorbital region being less constricted. The zygomata are not wide spreading and not markedly arched. The lambdoidal and sagittal crests are not specially prominent; the skull is narrower across mastoids and the parietals bulge out decidedly. Bullæ seemingly somewhat smaller.

P. arizonensis may be distinguished from *P. longicauda* by its decidedly smaller size, darker color above, and by the cranial differences noted above.

Distribution.—The Mountain Weasel is found from Arizona and New Mexico north through the Rocky Mountains and Sierra Nevadas, reaching British Columbia in the Rocky Mountains, but in the Cascades and Sierra Nevadas is not found north of the Siskiyou Mountains.

In Colorado it is found well distributed through the mountains, and onto the west edge of the plains; it is recorded from Colorado Springs, and Lake Moraine, El Paso County; from Fort Collins, Larimer County; Coventry, Montrose County; Crested Butte, and Sapinero, Gunnison County; Salida, Chaffee County; and from Boulder County. It has a range in elevation from six to above eleven thousand feet.

Habits.—The habits of this species do not differ essentially from those of other weasels. They live more in the mountains and foot-hills than the Long-tailed Weasel, but their prey is much the same.

Putorius streatori leptus (*streatori*, for C. P. Streater;
Grk. *leptos*, thin, fine, delicate). Dwarf Weasel.

Putorius streator leplus Merriam, *Proc. Biol. Soc. Wash.*, xvi., p. 76 (1903).

Type locality.—Silverton, Colorado.

Measurements.—Total length, 9.5; tail vert., 2.6; hind foot, 1.23.

Description.—Summer pelage, from Merriam *l. c.*, taken from a specimen from Alberta, Canada. Upper parts uniform drab brown (or between drab brown and hazel, but lacking the reddish of hazel); end of tail black; under parts white throughout, with straight line of demarcation along the sides, the white reaching down on under sides of legs to wrists and ankles; rest of legs and feet brown like back; toes of fore feet white on upper side; toes of hind feet mixed brown and white. A specimen taken in May, at Crested Butte, Gunnison County, in a pelage intermediate between winter and summer has the back a drab brown, without tinge of red; a very different color from the brown of *P. arizonensis*.

Winter pelage. White all over except the short black tip of the tail.

The skull is, naturally, small and rather delicate, with marked postorbital constriction; postorbital processes moderately developed; zygomata spreading but little, and somewhat arched; rostrum depressed; bullæ quite well inflated; lambdoidal crests somewhat prominent; sagittal crest wanting or barely noticeable.

The very small size of this weasel suffices to distinguish it from the other Colorado species.

Distribution.—The Dwarf Weasel is seemingly distributed from Henry House, Alberta, Canada, south through the Rocky Mountains to Colorado, and probably into northern New Mexico. In Colorado it has been taken at Silverton, San Juan County; in Larimer County; in Boulder County; at Crested Butte, Gunnison County; and at Coventry, Montrose County. It ranges high in the mountains, probably reaching, if not going above, timber-line.

Habits.—I know nothing of special interest concerning the habits of this species. Probably from its small size it feeds largely on mice. In the mountains where the snow is deep in winter, one often sees the track of this animal disappear under the snow and then reappear a little farther on, the weasel having run through the light snow a little below the surface, very likely following the trail of some unlucky mouse.

Genus LUTREOLA (diminutive of *lutra*, a little otter)

Lutreola Wagner Schreb., *Säugeth.*, Suppl. ii, p. 239 (1841). Type *Mustela lutreola* Linnæus.

Body long and slender; legs short; toes partly webbed; neck rather long; tail about one third total length, bushy; skull flattened above, outline rising very gradually from nasals to occiput, proportionally long; bullæ flattened; postorbital constriction marked; anal glands moderate; dentition: i. $\frac{3}{3}$; c. $\frac{1}{1}$; pm. $\frac{2}{2}$; m. $\frac{1}{2} \times 2 = 34$.

Semi-aquatic animals living along streams and about ponds and lakes, their food consisting of small mammals, birds, and fish.

The genus is found in eastern Europe, in temperate North America, and possibly in eastern Asia. Elliot's Check-list gives three species and four subspecies as found in North America, one of which inhabits Colorado.



FIG. 63. WESTERN MINK, *Lutreola vison energumenos*
Skull showing dentition $\times 1\frac{1}{2}$

Lutreola vison energumenos (*vison*, origin unknown: *energumenos*, Grk., possessed of an evil spirit).
Western Mink.

Lutreola vison energumenos Bangs, *Proc. Bost. Soc. Nat. Hist.*,
p. 5 (1896).

Type locality.—Sumas, British Columbia.

Measurements.—(Type, from Bangs): total length, 23.5; tail vert., 8; hind foot, 2.8.

Description.—Dark brown above, the longer guard hairs being somewhat darker than the shorter under fur; tail darker, and blacker toward tip; underparts a somewhat lighter brown; a white spot on chin and a few on underparts; these however vary much with individuals. There is considerable seasonal and individual variation in the general color of the fur.

Distribution.—This species is found in the Mackenzie River region, British America, from the Arctic Ocean (MacFarlane) south through the Rocky Mountain and Pacific States to central California, and through Colorado, and presumably New Mexico. It is found all through Colorado wherever there is sufficient water, ranging up to between 9,000 and 10,000 feet at least. It is quite common in many places, being found along the plains streams as well as in the mountains.

Habits.—Minks are animals of semi-aquatic habits, and are seldom found far away from water, living about the banks of streams and ponds, in holes and cavities. Their food consists of mice, or any other small animals, including rabbits, fish when they can get them, and such birds as they can catch. Occasionally one attacks the farmer's poultry, and then may do much damage, as, like all the weasel family, it will kill for the mere love of slaughter. The rut is in March and April, the young being born in May or June, and are five or six in number, though MacFarlane says that from eight to twelve have been known. Because of their valuable fur, mink are much trapped, but in spite of this they seem to hold their own pretty well, and even in the old thickly settled districts of the Eastern States are not at all uncommon.

Genus *MUSTELA* (Lat., a weasel)

Mustela Linnæus, *Syst. Nat.*, 10th. ed., i., p. 45 (1758). Type *Mustela martes* Linnæus.

Revision, Rhoads, *Proc. Acad. Nat. Sci. Phila.*, pp. 443-460 (1902).

Body long and slender; legs short; tail bushy, moderately long; soles furred, pads naked; superior outline of skull somewhat arched; zygomatic arch high; a considerable postorbital constriction; bullæ quite large; dentition: i. $\frac{3}{3}$; c. $\frac{1}{1}$; pm. $\frac{4}{4}$; m. $\frac{1}{2} \times 2 = 38$.

The members of this genus are inhabitants of the boreal and temperate portions of the northern hemisphere, living in the forested regions. It is really somewhat more widely spread than the preceding statement indicates, as in the Old World the genus extends from Europe to Java, Sumatra, and Borneo; in North America in the east it ranges south to northern Pennsylvania, and in the west probably to northern New Mexico and to the latitude of San Francisco on the Pacific Coast, and everywhere as far north, at least, as the forest extends.

Martens are largely arboreal in habits, preying on small mammals, birds and their eggs, and occasionally other animals. Those members of the genus living in the colder climates are valuable fur-bearing animals, the sable of the Old World being a member of the genus, while the pelts of the American martens bring high prices in the fur markets. Their outer fur is long and glossy, and there is a thick soft under-fur.

In America six species and five subspecies of what are usually called Martens are found, according to Elliot's Checklist, besides the large species called the Fisher (*Mustela canadensis*). Of these, one form of Marten is found in the mountains of Colorado. There have been rumors of the occurrence of the Fisher in this State, but they do not seem to have been based on facts.

Mustela caurina origenes (Lat. *caurus*, classical name of N. W. Wind; *origenes*, a mountain race). Rocky Mountain Marten.

Mustela caurina origenes Rhoads, *Proc. Acad. Nat. Sci. Phila.*, p. 458 (1902).

Type locality.—Marvine Mountain, Rio Blanco County, Colorado.

Measurements.—(Of type from Rhoads): Total length, 28.25; tail vert., 8.25; hind foot, 3.0.

Description.—Above brown, darkest on middle of back, paler on sides and somewhat fulvous; face, top of head, and chin a grayish brown; feet and legs dark brown; throat yellow and orange from chin to between fore legs (this varies much in individuals); belly palish brown, with orange between hind legs.

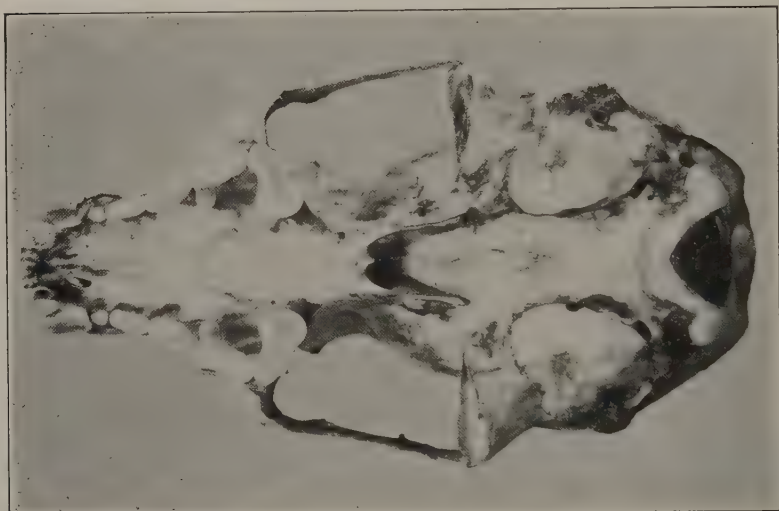


FIG. 64. ROCKY MOUNTAIN MARTEN, *Mustela caurina origenes*
Skull showing dentition, very slightly enlarged

Skull somewhat arched above; highest above middle of brain case; postorbital constriction marked; rostrum short; zygomata high; palate extends one third distance from plane of last molars to bullæ; last upper molar peculiarly saddle-shaped, its greatest dimension being the transverse one, the tooth being depressed in the middle and high on either side.

Distribution.—The distribution of this Marten is given as the southern Rocky Mountain region, and we have at present no more definite information at hand. In Colorado it is probably found all through the heavy spruce forests of the main range, and those to the west. We have no information as to any records of its occurrence in the Pike's Peak Range. In some localities it is fairly common.

Habits.—The Marten is of arboreal habits, spending most of its time in trees, living on mice, squirrels, and such birds as it may be able to capture. It also feeds on rabbits and mountain rats. MacFarlane states that the rut of British American martens is in February and March; that the young are six in a litter, are blind and helpless when born, and that the nests are in hollow trees, under fallen timber, and in holes in the ground. The fur being so valuable much trapping is done for them, and many are taken annually.

Genus GULO (Lat. *gula*, the throat, gullet, hence gluttony)

Gulo Frisch, *Das Natur. Syst., vierfüss. Thiere*, in Tabellen 17, Tab. Gen. (1775). Type *Mustela gulo* Linnæus.

Size large, stout; legs short; tail bushy and short; soles hairy with six naked pads; claws sharp and strong; skull massive, superior outline arched; zygomata widely divergent, strong, high behind; bullæ moderately inflated on inner half and laterally elongated into tubes; orbital constriction slight; palate broad and extending nearly half way from the last molar to the bullæ; rostrum short and stout; dentition: i. $\frac{3}{8}$; c. $\frac{1}{4}$; pm. $\frac{4}{4}$; m. $\frac{1}{3} \times 2 = 38$.

The Wolverine or Glutton is an inhabitant of the northern portions of northern Europe, Asia, and America. It is, for its size, a very powerful animal; it lives on meat of any kind, and, if reports be true, is not particular as to killing it itself.

Elliot in his Check-list gives three species as found on this continent, one of which, the type species, is found in Colorado.

Gulo luscus (Lat. one-eyed, blind, perhaps in allusion to small eyes). Wolverine.

Ursus luscus Linn., *Syst. Nat.*, 10th ed., i., p. 47 (1758).

Type locality.—Hudson Bay.

Measurements.—(From a Breckenridge, Colo., specimen in Carter Collection): Total length, 38.7; tail vert., 8.2; the two following are from Elliot: hind foot, 2.5–3.15; ear, 2.

Description.—(From a specimen taken near Breckenridge, Colo., in the Colorado Museum of Natural History, Denver): above dark brown; lighter, more fulvous along sides and at base of tail; tail like

back; top of head grizzled; face, muzzle, and chin brown; the throat in this specimen has a large white patch, but in another from the same locality there is but a small patch of white; feet and underparts brown.

Distribution.—The Wolverine is found from the Arctic Ocean south through British America to the northern border of the United States on the east. At one time it was found in the New England States and Northern New York, but has been exterminated in those localities. According to Rhoads there is also a single Pennsylvania record. It is possibly found in the northern peninsula of Michigan and in northern Minnesota. In the western United States they are found in the higher parts of the Rocky Mountains, in the Sierra Nevadas, and in the northern Coast ranges. In the Rocky Mountains it ranges through Colorado nearly if not into northern New Mexico. In Colorado it is found sparingly through the heavy forests in the high mountains, and has been recorded from Gunnison County (Warren); from Trappers' Lake, Garfield County (Cooper); from near Placerville, San Miguel County (Smith); and from Breckenridge, Summit County (Carter).

Habits.—Wolverenes, also known in the north as Carcajou, are animals of very powerful build and of destructive habits. Their food consists of any animal they may be able to capture, dead animals are not despised, and they will take those that are caught in traps and devour them. Caches of provisions left by hunters, prospectors, or explorers are torn up, their contents eaten or destroyed. The Wolverine, in the north, often follows a line of traps, eating or hiding animals that may be caught, even such large ones as a lynx, tears up and hides or carries away the traps—in fact, destroys everything in its power. MacFarlane says: "The wolverene is undoubtedly entitled to first place among the destructive animals of North America, and is also the most detested of them all." He also says the rutting season is in March and April, and that the young are born about sixty days later, being from one to three in a litter, occasionally as many as five.

The fur has considerable value, and is especially prized by the Eskimos for trimming their hoods. Preble says that

an Eskimo followed his party ten miles by kayak to the Hudson Bay Company post for which he was bound, in order to have the first chance to trade for some Wolverine furs Preble's party was taking to the post.

Subfamily MELINÆ

Terrestrial and often fossorial carnivora with somewhat rounded heads and elongated feet, the toes of which are straight and not webbed, and the claws but slightly curved, subcompressed, and blunt, those of the fore feet being specially large; kidneys simple.

Genus TAXIDEA (Lat. *taxus*, a badger + Grk. *eidos*, form)

Taxidea Storr, *Prodr. Meth. Mamm.*, p. 34 (1780). Type *Ursus taxus* Schreber.

Body stout, strong, and flat-looking; legs short, but powerful; fore claws very long and strong; tail short; skull wedge-shaped; lambdoidal crest greatly developed, sagittal but little; bullæ large; end of palate halfway between molars and bullæ; dentition: i. $\frac{3}{2}$; c. $\frac{1}{1}$; pm. $\frac{3}{2}$; m. $\frac{1}{2} \times 2 = 34$; upper carnassial largest.

This genus is peculiar to North America, and there represents the Old World badgers. It is found in the western half of the continent; in the United States from Wisconsin to Texas and westward. They are animals of entirely terrestrial and fossorial habits, being powerful burrowers and obtaining much of their food by digging out animals from their holes.

Elliot's Check-list gives one species with three subspecies, four forms in all; of which one is an inhabitant of Colorado.

Taxidea taxus. Badger

Ursus taxus Schreber, *Säugeth.*, iii., p. 520 (1778).

Measurements.—Total length, 29; tail vert., 5.8; hind foot, 4.5. Rather a large specimen.

Description.—(From a specimen taken in Park County, August 6th): The hairs of the upper part of the body are a pale buff on the inner half, next the skin, or perhaps ecru would be a better name

for the color; then about half the outer portions are black, and the tip white, thus giving a grizzled grayish look to the whole upper surface except along the middle of the back where white tips to the hairs are wanting or nearly so. The hairs are much longer on the sides of the body and the white tips correspondingly so, making the sides look much grayer; the head is blackish above, with a narrow white stripe extending from about half way between eyes and nose to the occiput; back of ears with a black border; a buffy patch on cheek and around back of eye; entire underparts, including under side of tail, clear buff, except a short white streak on middle of belly; chin and throat somewhat paler; upper part of tail like under, just a little grizzled; feet and legs black.

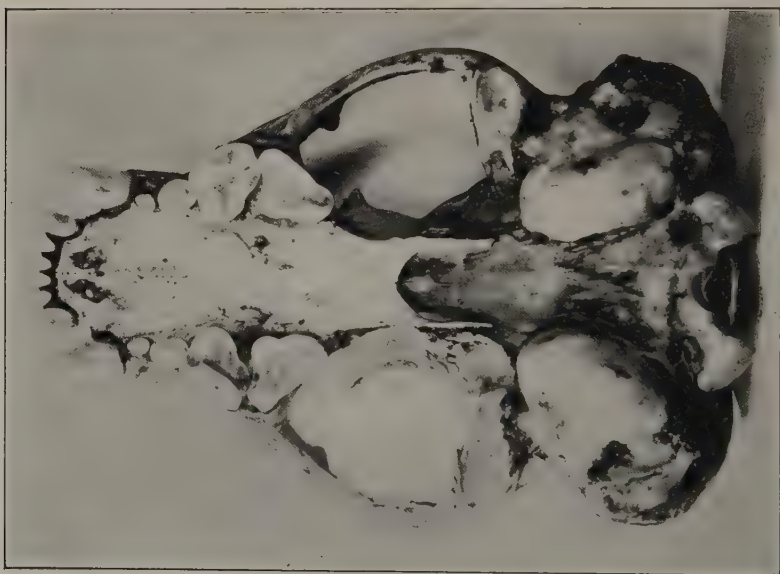


FIG. 65. BADGER, *Taxidea taxus*
Skull showing dentition $\times \frac{1}{2}$

In some specimens the white stripe on top of head extends back between shoulders, and also forward to end of nose. Two Gunnison County specimens are darker and richer in color than the one from which the description was drawn up, and have longer hair; one was taken on nearly same day of month as above described specimen, and the black and white parts are much more in evidence and the resultant effect consequently handsomer.

The skull is easily distinguished from that of any other Colorado mammal by the peculiar wedge-shaped form, widest posteriorly, and the brain case is pronouncedly triangular in shape. The post-orbital constriction is marked; the occipital or lambdoidal crest very prominent, while, except in very old animals, the sagittal crest is nearly or wholly absent.

The upper molar is triangular, apex at posterior, and is very tubercular. The upper carnassial has two large and two small cusps. Canines large and strong.

Distribution.—The typical form of *Taxidea taxus* is found from 58° north latitude south to Oklahoma, and from Wisconsin west to and into the Rocky Mountains. In Colorado it is found over the whole of the State up to timber-line.



FIG. 66. BADGER, *Taxidea taxus*
From life, E. R. Warren, Photo.

Habits.—The Badger is a great digger, for which its long strong claws are well adapted, and obtains much of its food by digging various small animals from their burrows. Prairie-dogs, the various spermophiles, and ground squirrels all

fall victims to these energetic foes, which can soon enlarge a hole sufficiently to enable them to enter and follow their prey. They are extremely useful animals, doing little or no harm to man, but rendering great service by destroying many harmful rodents. It is true that the large holes the badger sometimes digs are dangerous to horsemen on the plains, but this is not a sufficient excuse for killing the animal at sight, as is too often done. We have no exact information as to their breeding habits, but the young are said to be three or four and are born some time in the spring.

Genus MEPHITIS (Lat., a pestilential exhalation)

Mephitis Cuvier, *Leçon Anat. Comp.*, i., tabl. 1, Class Mamm. (1800). Type *Viverra mephitis* Schreber.

Revision, Howell, *N. A. Fauna*, No. 20 (1901).

The skunks of this genus are moderately small stocky animals, heavy behind, with rather sharp noses, small ears, short legs, and long bushy tails; the hair is long and loose with a dense under-fur; the colors are the same in all the species, black and white, the latter color being in a narrow frontal stripe, and two dorsal stripes of varying width, sometimes almost or wholly wanting, and again uniting and forming a broad band on whole back. The females are smaller than the males. The skull is arched and highest in the frontal region; hinder end of palate nearly on a line with the posterior portion of last molars; postorbital processes not prominent; dentition: i. $\frac{3}{3}$; c. $\frac{1}{1}$; pm. $\frac{3}{3}$; m. $\frac{1}{2} \times 2 = 34$.

The malodorous fluid which has made the skunk notorious wherever it is known, and is such a powerful means of defence, is secreted by two anal glands described by Dr. C. Hart Merriam as follows: "The glands lie on either side of the rectum, and are imbedded in a dense gizzard-like mass of muscle which serves to compress them so forcibly that the contained fluid may be ejected to the distance of four or five metres (approximately 13 to 16½ feet). Each sac is furnished with a single duct that leads into a prominent nipple-like papilla that is capable of being protruded from the anus, and by means of which the direction of the jet

is governed.”—"Mammals of the Adirondack Region," *Trans. Linn. Soc. N. Y.*, i., p. 76, 1882.

Skunks are terrestrial animals, living in caves or burrows, and are good diggers. They live on small mammals, reptiles, batrachians, birds and birds' eggs, and insects. In the summer they destroy great numbers of grasshoppers. Occasionally a raid is made on the farmer's henhouse, and then they may do considerable damage; but no doubt they are more useful than injurious.

Large numbers are annually trapped for their fur, and their pelts are sold by thousands.

This is an exclusively American genus, ranging northward from Guatemala to Great Slave Lake, in the interior, while on the Atlantic Coast skunks have not been taken north of Nova Scotia, and on the Pacific Coast Stuart Lake, British Columbia, is the most northerly record. Nine species, with eight subspecies are given by Elliot in his Check-list, of which two have been taken in Colorado.

KEY OF THE SPECIES

- A. Tail comparatively short, much less than $\frac{1}{2}$ total length; hind foot long, in males 3.25, in females 2.75; body proportionately heavy. **Mephitis hudsonica**, p. 209
- B. Tail long, almost $\frac{1}{2}$ total length; hind foot in males 3 or less, in females, 2.6; body not as stoutly built as in the preceding (total length is approximately the same in both species). **Mephitis mesomelas varians**, p. 211

Mephitis hudsonica. Northern Plains Skunk

Mephitis hudsonica Richardson, *Fauna Boreali Americana*, i., Mamm., p. 55 (1829).

Type locality.—Plains of the Saskatchewan.

Measurements.—Average of 3 males (Howell, *l.c.*): Total length, 28.5; tail vert., 10.5; hind foot, 3.25. Average of 3 females (Howell), total length, 23.75; tail vert., 9.85; hind foot, 2.75.

Description.—The color pattern is in nowise different from that usual in this group of skunks, there being a narrow white stripe on the head, from the nose backwards; and another beginning at

nape, running back and forking behind shoulders, extending to tail and along sides of that nearly to tip; there is also an indistinct band of white on tail about two thirds of the distance from the root to the tip. But there is so much variation in the amount of white that practically no two specimens are alike, and it is impossible to draw up descriptions to fit them all, and no separation of the species can be made by color characters alone.

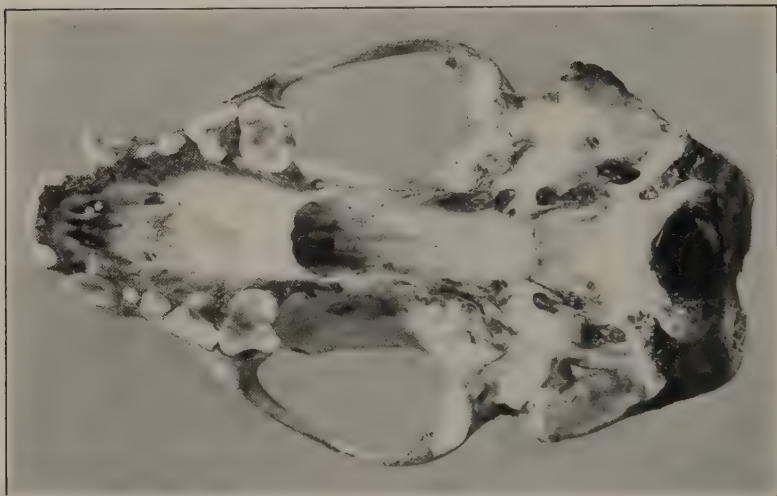


FIG. 67. NORTHERN PLAINS SKUNK, *Mephitis hudsonica*
Skull showing dentition, somewhat enlarged

The skull is large and broad, with prominent mastoid processes; the zygomata are widely expanded; the palate is long and ends behind posterior molars, without notch or spine; interorbital constriction marked; nasals short; dentition heavy.

Distribution.—This species is found from Fort Simpson, in the Mackenzie River region, Lat. 62° north, south into Nebraska and Colorado. Its east and west range is from Minnesota to Washington, but it does not seem to have been recorded from the Pacific Coast in the latter State, nor does Howell mention any records from Oregon or California. At the same time Minnesota is the most eastern record, and it seems to be principally in the prairie and the mountain States to the west.

At present we have but comparatively few Colorado records, though it is no doubt more widely distributed than these would

indicate. Arkins, Larimer County, Salida, and Colorado Springs, with one from Coventry, Montrose County, are all the records at hand, while one or two skulls from Barr, Adams County, seem to belong to this species.

Habits.—The skunks of the genus *Mephitis* are of similar habits, which have already been partly described in the account of the genus. While they are mainly of nocturnal habits, yet they are frequently seen abroad in daylight. Besides eating such insects as grasshoppers, they also dig up and eat those grubs which bury themselves in the ground. They do not hibernate regularly, but in the severest winter weather may stay in their dens for some days. Skunks often get excessively fat when food is abundant, so much so that their skins are often difficult to take care of and preserve properly.

Mephitis mesomelas varians (Grk. *mesos*, middle, + *melas*, black, referring to black stripe between white ones; *variens*, Lat. varying). Long-Tailed Texas Skunk.

Mephitis varians Gray, *Charlesworth's Mag. Nat. Hist.*, i., p. 581 (1837).

Type locality.—Texas. (Specimens from lower Rio Grande Valley considered typical, Howell.)

Measurements.—Male: Total length, 28.5; tail vert., 13.25; hind foot, 3.0. Female: Total length, 26.35; tail vert., 11.25; hind foot, 2.70. There seems to be much variation in Colorado specimens as to the relative length of tail.

Description.—Color and markings much as in preceding species. Two specimens from Wray, Yuma County, in my collection exhibit extremes in amount of white showing in tail, one having the white stripes along the sides of the tail practically obsolete, only a few white hairs showing, and it is not until one lifts up the hairs that the white inner portion is seen. In the other probably 80 per cent. of the tail shows white, and it ends in a scanty tuft of white hairs extending three inches beyond the rest of the tail.

The skull is smaller and narrower than that of *M. hudsonica*, with less abruptly spreading zygomata. Palate shorter than in *hudsonica*, posterior end even with or anterior to plane of posterior portion of last molars.

The cranial characters, shorter hind foot, and relatively long tail, and consequently smaller body, serve to separate this species from *M. hudsonica*. It should be said that specimens from Colorado, which seems to be the northwestern limit of its range, have shorter tails than the typical form from Texas, in which the tail is more than one half the total length.

Distribution.—This is a more southern species than the preceding, being found from Nebraska and Colorado south into Mexico, and the two States just named seem to define its longitudinal limits, it also being found in Kansas, Oklahoma, New Mexico, and western Texas. It probably does not range very far south into Mexico. In Colorado it has been met with in Larimer, Boulder, Yuma, El Paso, Kiowa, Baca, Prowers, Las Animas, Fremont, Costilla, Gunnison, and Montrose counties.



FIG. 68. LONG-TAILED TEXAS SKUNK, *Mephitis mesomelas varians*
In trap. E. R. Warren, Photo.

Genus SPILOGALE (Grk. *spilos*, spot, + *gale*, weasel)

Spilogale Gray, *Proc. Zool. Soc. London*, p. 150 (1865). Type, *Mephitis interrupta* Rafinesque.

Revision, Howell, *N. A. Fauna*, No. 26 (1906).

Smaller than *Mephitis* with more slender bodies; pads on both fore and hind feet divided into four tubercles at base of toes. Pattern of coloration entirely different from that of *Mephitis* and for all Colorado species may be described as follows: Ground color black; white spot on forehead between eyes; four parallel white stripes on upper parts, commencing between or just behind ears, and extending to about the middle of the back, the outer one on each side continued forward under and in front of the ear; a white stripe on each side commencing just behind the fore leg, and extending backward parallel with the stripe above and somewhat farther back, then curving up onto the back, stopping about even with the inside edge of that stripe; between the ends of the two transverse stripes thus formed are two white spots or patches, in line with the two inner dorsal stripes; at about the hips, or a little in front, are two transverse white bands reaching about to the line of the median stripes; a small white patch on each side of rump; a narrow white stripe or patch on each side of tail at base; end of tail white in all Colorado species except *S. interrupta*. Practically the only variations in this pattern are in the width of the white stripes, and the length of the dorsal stripes, but the skunks of this genus are much more uniform in their markings than the species of *Mephitis*.

Cranial characters: Skull flattened, with rostrum only slightly depressed below plane of upper surface; periotic region and auditory bullæ greatly inflated; mastoid and paroccipital processes obsolete or very small; postorbital processes well developed; tube of auditory meatus directed forward; zygomatics highly arched, and the highest point at the middle of the arch; dentition: i. $\frac{3}{3}$; c. $\frac{1}{1}$; pm. $\frac{3}{3}$; m. $\frac{1}{1}$ $\times 2 = 34$; upper molar wider than long.

Howell's revision of this genus gives twenty species and subspecies as belonging to it, four of which have been taken in Colorado; these have quite a wide distribution in some respects, but do not range above the Transition Zone, 8,000 feet being about the limit of elevation in Colorado. Looking at the distribution map in Howell's paper, one would say that the word "spotted" described the distribution of the group, for, while widely distributed geographically, there are large areas without a representative of the genus. In the United States the following States have some species of Spotted Skunk inhabiting them: Virginia, West Virginia

North and South Carolina, Georgia, Kentucky, Tennessee, eastern Florida, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Kansas, Nebraska, Iowa, South Dakota, Colorado, Utah, New Mexico, Arizona, Nevada, Idaho, Washington, Oregon, and California, and the genus is also found in Lower California, and southward through Mexico as far as Guatemala.

KEY OF THE SPECIES

- A. Tail without white tip. **S. interrupta**, p. 214
- B. Tail with white tip.
 - a. Skull and brain-case broad and flat; auditory bullæ and mastoid capsules well inflated, rather prominent from above and behind.
 - a'. Zygomata widely and abruptly expanded, highly arched upward. **S. arizonæ**, p. 216
 - b'. Zygomata not so widely expanded, and not so highly arched. **S. tenuis**, p. 216
 - b. Skull and brain-case flat as above, but the lambdoidal ridge is lower, so that when the skull is viewed from behind much more of the upper part of the brain-case is seen; auditory bullæ and mastoid capsules not so inflated as to be noticeable from above. **S. gracilis saxatilis**, p. 217

Spilogale interrupta (Lat. breaking apart, interrupted, referring to the markings). Prairie Spotted Skunk.

Mephitis interrupta Rafinesque, *Annals of Nature*, i., p. 3 (1820).

Type locality.—"Upper Missouri" River.

Measurements.—(Of specimen described below): Total length, 19.1; tail vert., 7.85; hind foot, 2.05.

Description.—(From a specimen taken at Wray, Yuma County, March 5th): White markings as described for genus, but the stripes are all narrow, the dorsal ones especially so; spots rather small; tail full and bushy, and just a very few white hairs in tip, but it is not conspicuously white-tipped. Skull rather small and slender, brain-case arched; auditory bullæ and mastoid capsules only moderately inflated.

The full bushy tail, with little or no white at tip, at once distinguishes *interrupta* from the other three species of *Spilogale* found in Colorado. In general the extent of the white marking is much more restricted than in the other three species.

Distribution.—The Prairie Spotted Skunk is found in Iowa,

southern Minnesota, Nebraska, Kansas, Missouri, Oklahoma, south in east Texas to middle of State, and in Colorado has been taken at Wray, Yuma County, but a few miles west of the Nebraska line.

Habits.—The spotted skunks have the same means of defence as the larger species. They are, however, somewhat different in their habits, being lighter in build, and more agile, often climbing trees and bushes. They seem to make their homes about rocks, whenever possible. However, when no rocky places are available they will use holes elsewhere, and dig burrows for themselves. They are said to be strictly nocturnal in habits, and so are but rarely seen abroad. Merriam says that when moving about in the moonlight their markings blend with the lights and shadows in such a way as to render the animals very inconspicuous.

The spotted skunks in many parts of the west are known as "Hydrophobia Skunks" or "Phoby Cats." The notion prevails that their bite invariably causes hydrophobia, and is fatal. Howell says in his revision of the genus: "While there are a few authentic cases of skunk bite having resulted fatally, there are also many instances in which it has produced no ill effect whatever. The recorded cases of skunk rabies are nearly all from the plains region of the West (Kansas, Texas, and Arizona) and relate more to *Mephitis* than to *Spilogale*. The most plausible explanation of these facts seems to be that at certain periods rabies may become locally epidemic among dogs and wolves, and by them be communicated to skunks." We have never heard of any cases of this sort in Colorado, though one occasionally hears of mad wolves or coyotes, usually newspaper stories.

The food is much the same as that of the other skunks, though presumably they do not attack as large animals, and possibly they eat more insects, and also, because of their climbing abilities, may catch more small birds.

Spilogale arizonæ. Arizona Spotted Skunk

Spilogale phenax arizonæ Mearns, *Bull. Amer. Mus. Nat. Hist.*, iii., p. 256 (1891).

Type locality.—Fort Verde, Arizona.

Measurements.—Total length, 16.5; tail vert., 5.1; hind foot, 1.7.

Description.—Color and markings much as in other species; tail with terminal fourth above, and terminal third below, white.

The skull is rather large; the zygomata are widely and abruptly expanded, arched upward at the highest point, higher in this particular than in any other of our species of the genus; this is especially noticeable when the skull is viewed from behind; rostrum and intertemporal region narrow; the bullæ and mastoid capsules are noticeably much inflated; upper molar relatively small.

The highly arched zygomata and greatly inflated bullæ and capsules are the principal points by which *arizonæ* may be distinguished from the other Colorado species of *Spilogale*.

Distribution.—The Arizona Spotted Skunk is found in central and southern Arizona, western New Mexico, and adjacent parts of Mexico, and has been taken at two Colorado localities, Salida and Coventry, but has not heretofore been recorded, this being the first publication of these records. At Coventry *S. g. saxatilis* has also been taken, and seems to be the more common.

Spilogale tenuis (Lat. thin, fine, delicate). Rocky Mountain Spotted Skunk.

Spilogale tenuis Howell, *Proc. Biol. Soc. Wash.*, xv., p. 21 (1902).

Type locality.—Arkins, Larimer County, Colorado.

Measurements.—(Of type, from Howell): Total length, 17.7; tail vert., 6.5; hind foot, 2.0.

Description.—Markings as described for genus, terminal third of tail white. Brain-case broad and very flat; fronto-parietal region not elevated above plane of skull; rostrum and postorbital region narrow, but without pronounced constriction, the narrowness also including the anterior portion of brain-case; auditory bullæ and mastoid capsules more inflated than in case of either the other Colorado species except *arizonæ*, especially noticeable from above. The posterior end of the skull is higher than in *saxatilis* or *interrupta*, hiding, when skull is viewed from behind, the greater part of the brain-case. Teeth rather small.

Distribution.—Howell gives the distribution of this species as: "Eastern slopes of the Rocky Mountains in Colorado and New Mexico; limits of range unknown." In Colorado it has been taken at Arkins, Larimer County; at Estes Park; at Boulder; and possibly

at Sedalia, where a specimen of a spotted skunk was taken and which is now mounted and in the Museum of Colorado College.



FIG. 69. GREAT BASIN SPOTTED SKUNK, *Spilogale gracilis saxatilis*
Skull showing dentition $\times 1\frac{2}{3}$

***Spilogale gracilis saxatilis* (Lat. *gracilis*, slender, thin).**
Great Basin Spotted Skunk.

Spilogale saxatilis Merriam, *N. A. Fauna*, No. 4, p. 13 (1890).

Type locality.—Provo, Utah.

Measurements.—Total length, 17.75; tail vert., 6.00; hind foot, 2.0.

Description.—Markings as described for genus, terminal third of tail white. Auditory bullæ and mastoid capsules not much inflated, and not very noticeable from above; brain-case flattened; fronto-parietal region depressed to general level of upper surface of skull; postorbital constriction pronounced; teeth rather small; ridge on mastoids pronounced; posterior end of skull lower than in *tenuis*, and when skull is viewed from behind the brain-case shows quite high above the lambdoidal ridge. This is one of the characters distinguishing this species from *S. tenuis*, and others are the much less inflated bullæ and mastoid capsules, more pronounced postorbital constriction, and ridge on mastoids.

There seems to be no difference in markings sufficient to distinguish it from the other species.

Distribution.—The Great Basin Spotted Skunk is found in Utah, western Colorado, northern Nevada, southern Idaho, eastern Oregon, and northeastern California. In Colorado it is found in western Routt and Rio Blanco counties, is recorded from Grand Junction and Newcastle, probably having its eastern limit in the Grand Valley at about Glenwood Springs; it is also recorded from Coventry, Montrose County. Its eastern limit in Routt County seems to be Sunny Peak. In this State it ranges somewhat above 7,000 feet.

Family PROCYONIDÆ

Smaller and less bulky forms than bears, with plantigrade or semi-plantigrade limbs and a long tail, which is generally annulated and sometimes prehensile; five toes to both limbs, with the claws short, curved, and non-retractile; skull with the bullæ and paroccipital process as in the *Ursidæ*, but without alisphenoid canal; dentition with molars $\frac{2}{2}$, tuberculate or multicuspid; upper carnassial short and broad.

KEY OF THE GENERA

- A. Form more stout; feet plantigrade, soles naked; tail short, about half the length of the body. **Procyon**, p. 218
- B. Form more slender; feet more or less digitigrade; soles partly hairy; tail as long as the body. **Bassariscus**, p. 220

Genus PROCYON (Lat. *Procyon*, Grk. *Prokuon*, *pro*, before, + *kuon*, dog, a star or constellation rising a little before the dog star).

Procyon Storr, *Prodr. Meth. Mamm.*, p. 35 (1780). Type *Ursus lotor* Linnaeus.

Body stout; tail rather bushy, about $\frac{1}{2}$ length of body, annulated; soles naked, feet plantigrade; muzzle pointed; ears short; palate extending back of molars nearly $\frac{1}{2}$ the distance to foramen magnum; dentition: i. $\frac{2}{2}$; c. $\frac{1}{1}$; pm. $\frac{4}{4}$; m. $\frac{3}{3} \times 2 = 40$.

This genus is confined to the New World and is spread over both the northern and southern Americas. In North and Middle America there are found, according to Elliot's Check-list, three species, one of which is further subdivided

into ten subspecies, only one of which has been met with in Colorado.

They are heavily built, nocturnal, omnivorous animals; in cold climates they hibernate, but in warmer regions are out all winter. They live both among trees and rocks, but where possible their favorite retreats and dens are hollow trees.

***Procyon lotor* (Lat., to wash). Raccoon**

Ursus lotor Linnaeus, *Syst. Nat.*, 10th ed., i., p. 48 (1758).

Type locality.—Eastern United States.

Measurements.—Total length, 30.5; tail vert., 10.25; hind foot, 4.1.

Description.—(From a specimen taken at Littleton, Colorado, in the Colorado Museum of Natural History, Denver): Dark grizzled above, hairs white-tipped, black and brownish at base. Tail ringed with black, brown, and grayish, the rings, however, do not meet on under side; 5 dark rings and black tip; a blackish stripe running back from ears; a whitish gray stripe extending from above eye toward front of ear, and less distinctly, but broader, around under above-mentioned black stripes; a broad black stripe below this light one, which takes in eye and extends about as far as ear; a narrow dark stripe on median line of nose; sides of muzzle whitish gray, and a light stripe lies under the black one; under parts, and feet and legs grayish, rather light.

Distribution.—The Raccoon, with its subspecies, is distributed over most of the United States, excepting the Rocky Mountain States north of Colorado. In Colorado it is very irregularly distributed, and we have but little data concerning it. It has, with the exception of certain localities in Grand County, been reported from the east of the Continental Divide only. It is said to be rather common north of the Arkansas-Platte Divide, but south of it it is very rare. It is recorded from Boulder, Larimer, Weld, Arapahoe, and Yuma counties, and also from central southern Las Animas County, near Watervale.

Habits.—Raccoons are nocturnal in their habits, seldom seen abroad in the daytime, and as for their food, they are as omnivorous as bears, and eat both vegetable and animal substances. Birds and various small animals fall victims, and when opportunity offers they raid hen-roosts. They are notoriously fond of corn when it is in the milk, and visit the fields regularly to obtain it. They are known, in California at

least, to raid melon patches. They live in hollow trees, or in dens among rocks or under banks. The young, varying from three to six, are born in April or May. A very peculiar habit is that they invariably wash their food, whenever possible, before eating it. This they do by holding it in the fore paws and dipping it into the water.

Genus BASSARISCUS (Grk. *bassaris*, a fox)

Bassariscus Coues, *Science*, ix., p. 516 (1887). Type *Bassaris astuta* Lichtenstein.

Body rather slender and elongated; tail long as body, annulated; ears rather large; pads of feet naked, soles hairy; head with short pointed muzzle; skull flat above; palate ends opposite the posterior portion of the last molars; dentition: i. $\frac{3}{5}$; c. $\frac{1}{1}$; pm. $\frac{4}{4}$; m. $\frac{3}{3} \times 2 = 40$.

Eight species and subspecies of this genus have been described, of which *B. astutus* and two subspecies occur in the United States, being found in the southwest, from Texas west to the Pacific Coast and north into Oregon; one is found in southwestern Colorado.

These are nocturnal animals, living among trees, and also among rocks, probably depending on locality and circumstances.

Bassariscus astutus (Lat., cunning, crafty). Ring-Tail

Bassaris astuta Lichtenstein, *Isis*, xxiv., p. 513 (1831).

Type locality.—Southern Mexico.

Measurements.—Total length, 28; tail vert., 13; hind foot, 2.3.

Description.—(From a specimen taken in western San Miguel County, Colorado, in February): Above, a pale buffy, mixed with longer black hairs, under fur plumbeous; under parts whitish, lightly tinged with buffy; chin and throat somewhat darker; tail above with alternate black and white bands, and black tip; the black does not quite meet on the underside of the tail, so that the centre line of that portion is continuously white. The extremely long ringed tail at once distinguishes it from any other Colorado mammal, or indeed, from any other mammal found in the United States.

The skull is rather long and slender, with short postorbital processes, and fairly prominent temporal ridges. The bullæ are of good size. The three anterior upper premolars are rather small,

sharp-pointed, the posterior much larger, with a well-developed inner cusp. The molars are of good size.

Distribution.—Elliot gives the distribution of this species as California through Arizona, New Mexico, and Texas. It is also found in southwestern Colorado, having been taken in Mesa County,



FIG. 70. RING-TAIL, *Bassariscus astutus*
Skull showing dentition $\times 1\frac{1}{8}$

in western Montrose and San Miguel counties. It is reported from Delta, from Durango, and from Montezuma County. It does not seem to be very common, but in the Paradox Valley, in western Montrose County, it was well known, and one has been taken near Coventry, Montrose County, 6,800 feet.

Habits.—The Ring-tail is an inhabitant of rocky places by choice, preferring to live among the stones and cliffs in the cañons and similar places. They are nocturnal and carnivorous in their diet, living on the various small rodents found in such places. The young are about four in a litter, and are born in late spring and early summer. They are said to be easily tamed and to make gentle and interesting pets.

Locally they are often called Civet Cats, which is not a good name, as it is not a civet at all, and to add to the confusion, the American fur dealers call the spotted skunks civets.

Family URSIDÆ

Large heavy animals with very short tails and plantigrade feet, each with five toes provided with long, compressed, moderately curved, and non-retractile claws; skull with a depressed flattened bulla, not inflated or divided; inferior lip of the long auditory meatus considerably prolonged; paroccipital process of the exoccipital standing free from, and not applied to, the bulla; the condyloid and glenoid foramina distinct; alisphenoid canal present; no cæcum; dentition with molars $\frac{2}{3}$, with broad flat tuberculated crowns; the three anterior premolars of both jaws rudimentary and often deciduous; the fourth upper premolar (carnassial) with no inner tubercle and root.

Genus URSUS (Lat., a bear)

Ursus Linnæus, *Syst. Nat.*, 10th ed., i., p. 57 (1758). Type *Ursus arctos* Linnæus.

Revision, Merriam, *Proc. Biol. Soc. Wash.*, x., pp. 65-83 (1896).

Size large, body heavy and bulky; feet broad with naked palms and soles; tail very short; ears short and erect; dentition: i. $\frac{3}{4}$; c. $\frac{1}{4}$; pm. $\frac{4}{4}$; m. $\frac{2}{3} \times 2 = 42$; fourth premolar larger than the three preceding; the upper, three-rooted; the lower one, two- ; none of the molars or premolars is sectorial in form, but rather tuberculate.

The Bears are widely spread over the world, but are not found in Africa or Australasia, and only one species is found in South America. In North and Middle America 16 species and 7 subspecies are found, according to Elliot's Check-list. Of these two have been met with in Colorado.

Bears are omnivorous animals living on both animal and vegetable food, and in the former class nothing seems to come amiss from grubs and ants up to cattle, and they

devour with relish berries of all kinds, acorns and nuts, dig up edible roots—in fact, nothing seems to be refused by them.

KEY OF THE SPECIES

- A. Size very large, length of adults 7 feet or more; claws on front feet much longer than those on hind feet; fur shaggy, variable in color, but never black, usually either brown or yellowish brown, with lighter tips.

U. horribilis and *U. h. horriæus*, p. 223

- B. Smaller, length of adults much less than 7 feet; claws of front feet little if any longer than those of hind feet; color black or cinnamon (brownish). *U. americanus*, p. 232

Ursus horribilis (Lat., horrible). Grizzly Bear.

Ursus horribilis horriæus (Lat., horrid, terrifying).

Sonora Grizzly.

Ursus horribilis Ord., *Guthr. Geog.*, 2d Amer. ed., ii., pp. 291, 299, 300 (1815).

Type locality.—Montana.

Ursus horribilis horriæus Baird, *Rept. Mex. Boundy. Sur.*, Mamm., ii., pp. 24-29 (1859).

Type locality.—Copper mines, Rio Mimbres, Grant County, southwestern New Mexico.

The status of the Colorado Grizzly is somewhat uncertain, and it is quite likely that both these forms occur in the State, in which case the typical form will be in the more northern portions, and the Sonora Grizzly in the southern.

Measurements.—(From Carter's notes, in the Colorado Museum of Natural History): Total length, 90; tail vert., 5.

Description.—The hairs are yellowish, gray-tipped, with dark base; the depth of the color of the base varies from brown to nearly black; legs and paws dark, almost black; ears brownish. It is the gray-tipping of the hairs which gives the grizzly or "silver-tip" color to the coat. Some specimens are dark brown, but a somewhat different brown from the cinnamon phase of the black bear. There is no difference in color between the two forms or subspecies of the Grizzly Bear. It is in the skull that the differences between the common Grizzly and the Sonora Grizzly are found. In the former the frontal region is elevated above the orbits, and highest behind the postorbital processes; in the latter the frontal region is not elevated above or behind the orbits, and is highest at, flattened and concave between, the postorbital processes.

There is a very marked difference between the skulls of the Grizzly and Black Bears, in fact the two species are placed in two

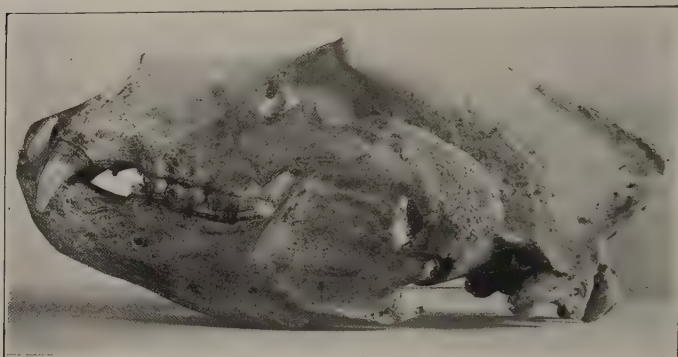


FIG. 71. GRIZZLY BEAR, *Ursus horribilis*
Side view of skull $\times \frac{1}{4}$

different subgenera, the former belonging to the subgenus *Danis*, and the latter to *Euarctos*.

The skull of the Grizzly is massive, and of course much the larger,

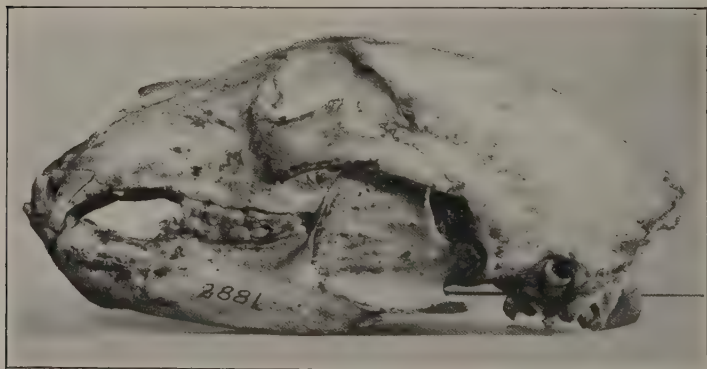


FIG. 72. BLACK BEAR, *Ursus americanus*
Side view of skull $\times \frac{1}{3}$. Note difference between profiles of grizzly and black bears

and presents a more angular, less rounded appearance; the temporal ridges or impressions meet anterior to the posterior end of

the frontals, and vary somewhat, being sometimes very well marked ridges and sometimes merely indicated. The profile of the top of the head is less rounded than in the Black Bear and the muzzle is shorter. The teeth are more massive.

Distribution.—Merriam, *l. c.*, pp. 74 and 75, gives the distribution of the typical Grizzly Bear as "Northern Rocky Mountains from Wyoming and northern Utah northward; also whole of interior British Columbia and thence northwestward in the interior to Norton Sound, Alaska." Preble states that it occurs in the Rocky Mountain Range west of the Mackenzie River north to the Arctic Coast. Merriam gives the range of the Sonoran Grizzly as "Southern Rocky Mountains and outlying peaks and ranges in Colorado, New Mexico, Arizona (and probably southern Utah), northern Mexico, and southern California. The type locality is the old Coppermines, near the Rio Mimbres, in Grant Co., New Mex."

In Colorado the Grizzly Bear is confined to the more mountainous portions of the State, and is apparently not now found in the foot-hills at the eastern base of the mountains. It ranges west to the Utah line.



FIG. 73. GRIZZLY BEAR, *Ursus horribilis*
Skull showing dentition $\times \frac{1}{4}$

Habits.—In some respects the Grizzly and Black Bears are of similar habits; in common with all bears which live where

the winters are in the least severe, they spend the winter in a state of hibernation, for which they prepare by laying on a very thick layer of fat. Their winter quarters may be caves or holes among rocks or banks, a cavity under the upturned roots of a fallen tree, or places among a number of fallen trees, where roots and tops lie together. Where there is a heavy snowfall the snow soon covers up any openings which may be present and protects the animal against the weather. While the bear usually stays in its den until spring, yet sometimes in mild winters or on warm days it may come out and wander round for a while. The bear is generally in fairly good condition as regards fat when it emerges from winter quarters, and its fur, while usually fairly good, is sometimes considerably worn by the animal turning about and rubbing against the sides of its den.

The rutting season is in the fall, and all over North America the young are born in January or February. The newborn bear is probably the smallest young known for such a large animal, with the possible exception of some of the very largest kangaroos. The measurements of the two-days-old cub of a European Brown Bear born in the New York Zoölogical Park are given by W. T. Hornaday in his *American Natural History* as: Length, head and body, $9\frac{3}{4}$ ins.; tail $\frac{1}{2}$ in.; height, 5 ins.; circumference of chest, $6\frac{3}{4}$ ins.; hind foot, $1\frac{1}{8}$ by $\frac{7}{8}$ ins.; weight, 15 ounces. Born January 17th. Two cubs are the usual number, but it varies from one to three, and in the case of the Black Bear four and five have been known. Grizzly Bears breed every two or three years, but Black Bears have been known to breed every year.

Bears are omnivorous, eating anything in the shape of food they may find, vegetable or animal, fresh or otherwise. This being the case, a bear can find a living almost anywhere. It will eat any carrion it may find, any animals it is able to kill,

from a steer down to a mouse or a chipmunk, often digging such small creatures as the latter and ground squirrels from their holes. Probably they do not kill very much large game, such as deer or elk, except it may be an occasional unfortunate crippled by some hunter and unable to get away. Any domestic animals that may come their way are taken care of, and sometimes on the cattle ranges a Grizzly becomes very destructive, levying a heavy toll on the herds. The victims are killed by blows from the powerful fore paws, one blow often being sufficient to kill a grown steer. The bear usually returns to its kill for several days or nights until it is consumed, but some of them get too wary for that and never come back a second time. Often after a bear has killed a large animal it drags it for a considerable distance with its fore paws to some convenient place, where it eats its fill, and then often covers, or partially covers, the remainder with leaves or moss or anything of the sort which may be at hand. Bears often tear open rotten logs to get the grubs which are in the wood; they tear open anthills and lick up the inhabitants with their tongues; the fondness of bears for honey is proverbial, and a bear will take almost any chances and endure almost anything to get honey. In Alaska and the northwest where salmon run in immense numbers in the streams, the bears of that region live largely on fish during the season. These they catch by wading out into the water, and feeling with their paws until a fish is found and thrown out on the bank or pulled out with the claws.

Bears are just as indifferent in their choice of vegetable food as in the case of flesh when hungry; even grass may be eaten when they come out in the spring and food is hard to get; berries in season are greatly relished, and a berry patch in the mountains is almost sure to have a bear frequenting it; service berries, raspberries, and wild cherries are all eaten, and the acorns of the scrub oaks are also gathered in.

While largely of nocturnal habits, bears may be found about at all hours of the day, especially in the less hunted regions. Still but few bears are seen by people, for a bear always avoids a person unless surprised in such a way that it cannot escape, so that even though one may be in a country where there are many bears, and indications of their presence plentiful, he may never lay eyes on one, unless he is especially looking and hunting for them. Despite his size and apparent clumsiness, a bear can move through brush very noiselessly, and very quickly too, if need be, so that the passer-by never suspects his presence.

In the early days before the advent of the breech-loading rifle the Grizzly was much less afraid of man than he is to-day, and, according to the reports of the early hunters and travelers in our western regions, had not the slightest hesitation in attacking a man on very little provocation. The Journal of Lewis and Clark gives several instances which occurred on their journey, and the narratives of others of the early travellers relate the same sort of stories. But since the guns have been so much improved the bears have found it to their advantage to act with more discretion and less valor toward man. Lewis and Clark, and other pioneer explorers, often refer to the Grizzlies as "White Bears."

One often reads reports of the enormous weights of bears killed by hunters, but these weights are always obtained, like those of the big fish that get away, by guess. The largest bear that was ever actually weighed of which we have any record was one which lived and died in Lincoln Park, Chicago. Its weight was 1,153 pounds. W. T. Hornaday thinks that the Rocky Mountains have not thus far produced a wild Grizzly weighing over 800 pounds. A Brown Bear killed by Captain Radcliffe, an English sportsman, in Alaska, in 1903, was cut up and weighed by him two days after it was killed. He had estimated the weight at 1,400

pounds. The actual weight, including the skin, was 968 pounds, and if 40 lbs. is allowed for blood lost and entrails removed, we have a total of about 1,010 lbs. This bear was in poor condition, and would probably have been a hundred pounds heavier when fat. It must be remembered that this was a larger species of bear than the Grizzly. It measured in the flesh 7 feet 9½ inches in length.

In the Journal of Jacob Fowler,¹ who travelled in 1821-22 from Fort Smith, Arkansas, through to Colorado and New Mexico, is given the account of the killing by a Grizzly Bear of Lewis Dawson, one of the party, at the mouth of the Purgatoire River, Nov. 13, 1821. The editor, Dr. Coues, says that Dawson was probably the first American citizen to die and be buried in Colorado.

It is quite well known that the bears in the Yellowstone National Park are one of the sights of that region as they come around the garbage dumps of some of the hotels to feed. They make their appearance at these dumps in the early evening, sometimes in good season in the afternoon, and enjoy a feast on the waste from the hotel kitchens. In the summer of 1904, the writer made a camping trip through the Park with a party of friends, and we had some decidedly interesting experiences with the animals. Our first acquaintance with them was in the Upper Basin at the Old Faithful Inn. With one of the party I went to the dump to see what could be seen, being very anxious to know if what we had heard about the tameness of the bears was true.

The dump at this place was located in an open space at the edge of the pine woods, and when we began our

¹ The Journal of Jacob Fowler, Narrating an Adventure from Arkansas through the Indian Territory, Oklahoma, Kansas, Colorado, and New Mexico, to the Sources of the Rio Grande del Norte, 1821-22. Edited, with Notes, by Elliott Coues. New York, Francis P. Harper, 1898.

watching there was only one small Black Bear, a yearling apparently, feeding, and him we promptly christened "Johnny Bear" after Thompson Seton's story. But very soon a big Grizzly came out of the woods directly back of the dump, and Johnny promptly vacated, hovering about the edges, and beating a hasty retreat every time the big bear looked his way. This went on some little time, ten or fifteen minutes perhaps, when another Grizzly came out of the woods just to one side of the dump and stood an instant looking about. Then Grizzly No. 1 turned and looked at him, and as if at a signal started for No. 2, who in his turn started off at his best pace along the open ground at the edge of the timber. One would not have supposed those clumsy-looking animals could travel as fast as they did, sprinting along and stirring up as much dust as a four-horse team. We watched them out of sight, shaking with laughter at the spectacle. As for Johnny Bear, the moment the Grizzly vacated he took possession and straightway began to make up for lost time. Going back to camp we passed the boarding-house of the stage drivers and stable hands of the Transportation Company. It was then about dusk, but seeing a bear or two about the kitchen door we stopped to watch, and presently there seemed to be so many bears moving around that place that I thought it wise to leave, fearing one of us might bump up against a bear in the dark and get into trouble.

It was at the Cañon that we had the most interesting and exciting time with the creatures. For the benefit of those readers who have been in the Park, I will say that our camp was on the opposite side of the road going toward Norris Basin from the "Wylie Camp," and a hundred or two yards farther away from the Cañon. We had in our outfit two wagons, one a canvas-covered spring wagon in which we rode, and the "chuck wagon" for supplies and camp outfit. This latter was an ordinary heavy wagon with bows, and sheet

stretched over them, with the "grub box" built up behind. On the ground beside this wagon one of our men and his wife had made their bed. On the other side, and farther along, about opposite the end of the pole, I had spread my blankets, and the friend who saw the foot race with me at the Old Faithful was close by. Another member of the party was some little distance away in another direction, and farther off still in a third direction was a tent occupied by the married couple of the outfit with their little boy. And at another point of the compass reposed our second man. We were decidedly scattered.

The first night in camp here an old bear with three cubs paid us a visit. The mother went beside the wagon, stood with one foot on the corner of the bed in which the two people slept, and reaching up tried to get into the wagon, tearing a hole in the cover in the attempt. She and her family were driven off, the camp being roused in the process. As it was full moon we had a good sight of them.

The next night we laid in a supply of ammunition in the shape of empty tin cans beside our beds. During the night I waked up with a feeling that there was something about, and raised up and twisted around in bed, and saw the old bear come alongside the wagon accompanied by two cubs. She walked on around the front wheels, and, stepping up on the pole, started to reach under the cover which was drawn down over the front. I decided then it was time to take a hand in the proceedings, and lifted up my gentle voice and requested the lady to leave at once, emphasizing my demand with a volley of tins thrown against the side of the wagon. She took the hint and stepped down and departed with her children, the third cub having been on the other side of my bed and close to me. Probably some noise made by it waked me. The four went down below the camp into a little park some fifty or seventy-five yards away, and there

we saw in the moonlight the old bear stand up on her hind legs, with the cubs about her, look about a moment and then down on all fours, and they all walked off.

Of course everybody was waked, and the married folks, not having seen the bears the night before, had left a request at the office for a call in case of another visit. So when some one yelled "Bear!" the lady's voice asked "Where?" and echo answered "There!"

Another bear or two paid us a visit in the night but were easily scared away. One bear paid a visit to the man who was sleeping by himself and poked its nose under the blankets, but desisted at the request to "Get out of there!" Bill said he was not going to let a little thing like a bear bother him, so went to sleep again. One bear came around during the day when everybody was away, but the lady and little boy happened to come back and he left before any harm was done.

W. H. Wright, in *The Grizzly Bear*, says that he found the bears in the Park as wild and suspicious as anywhere else, except in the immediate neighborhood of the dumps. Going to and coming from the dumps they were very cautious, as he found when trying to photograph them. We saw none of the animals away from the camps, though we did see signs.

Ursus americanus. Black Bear

Ursus americanus Pallas, *Spicilegia Zoologica*, fasc. xiv., p. 5 (1780).

Type locality.—Eastern North America.

Measurements.—I have no reliable measurements of this species at hand.

Description.—There are two color phases, one all black, with the nose tan color, the other cinnamon, or brown. These seem to occur irrespective of locality, and cubs of both colors have been known to have been born to one mother in the same litter.

Distribution.—Forest-covered parts of North America north of the

Lower Austral Zone. Merriam, *l. c.* In Colorado the Black Bear is found from the foot-hills west through the mountains to and beyond the Utah line, and from the north to the south boundaries. There are some Black Bears in the Fisher's Peak region in southern Las Animas County.

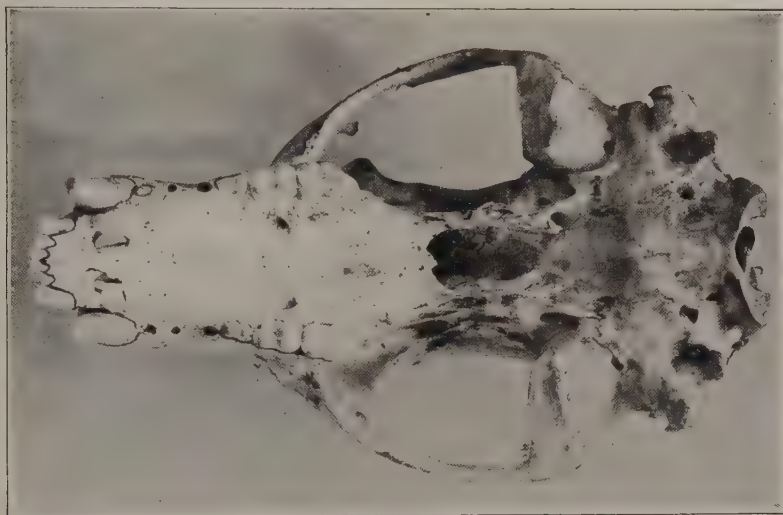


FIG. 74. BLACK BEAR, *Ursus americanus*
Skull showing dentition $\times \frac{2}{3}$

Habits.—There is nothing further to add concerning the habits to what has been said above.

Family CANIDÆ

The dogs, wolves, and foxes form a very distinct family, easily distinguished from the other Carnivora. The more easily recognizable characters are a somewhat elongated muzzle, a moderate tail, and well developed limbs; feet digitigrade, with four complete toes to the fore and five or sometimes four on the hind feet. Other characters are: skull with the postorbital processes short so that the orbit is

never surrounded by a ring of bone; auditory bullæ inflated but not divided into two chambers; alisphenoid canal present; dentition with four premolars on either side above and below; upper carnassial with two cusps, the anterior backwardly directed one being the larger, the posterior forming a compressed ridge, while there is also a small inner lobe at the anterior end of the tooth; the first upper molar large and broader than long, with the cusps on the external border; the second upper molar similar but smaller; the lower carnassial a large tooth, with anteriorly a well-developed bilobed blade, of which the hinder cusp is the larger; onto this latter hangs a small inner tubercle, while the posterior part of the tooth forms a well-marked tuberculated heel.

KEY OF THE GENERA

- A. Tail longer and more bushy, more than $\frac{1}{2}$ the length of the body; skull without a frontal sinus; postorbital processes convex.
 - a. Muzzle shorter; tail with a mane of stiff black hairs. Urocyon, p. 234
 - b. Muzzle longer; tail without mane. Vulpes, p. 236
- B. Tail shorter and less bushy, less than $\frac{1}{2}$ the length of the body; skull with a frontal sinus, and postorbital processes convex. Canis, p. 240

Genus UROCYON (Grk. *oura*, tail, + *kuon*, dog)

Urocyon Baird, *Mamm. N. Am.*, p. 121 (1857). Type *Canis virginianus* Erxleben.

"Tail with a concealed mane of stiff black hairs without any soft fur intermixed; muzzle short; temporal crests widely separated. Upper incisors scarcely lobed; postorbital processes bent but little downward, the anterior edge turned up, a longitudinal shallow pit at its base. Supplementary tubercle on the lower sectorial. Under jaw with an angular emargination below." Baird, *l. c.*

Dentition: i. $\frac{3}{3}$; c. $\frac{1}{1}$; pm. $\frac{4}{4}$; m. $\frac{3}{3} \times 2 = 42$.

Pupil elliptical.

This genus is found exclusively in North America, but does not have the extreme northern range of *Vulpes*, being a much more southern animal, ranging from Guatemala

northward through the United States to Washington, Wisconsin, and New Hampshire. In the west it frequents the lower altitudes, not ranging above the Transition Zone. Elliot's Check-list gives fourteen subspecies of the typical form, and two other full species. One of the subspecies is found in Colorado.

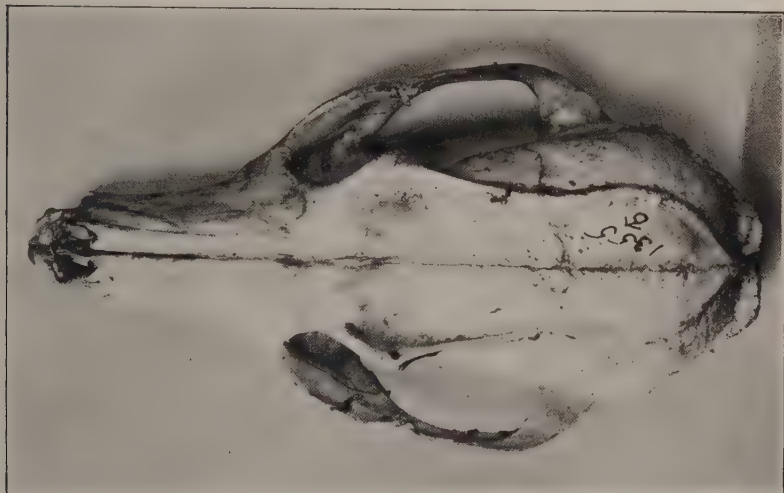


FIG. 75. SCOTT'S GRAY FOX, *Urocyon cinereo-argenteus scotti*
Dorsal view of skull $\times \frac{3}{4}$

Urocyon cinereo-argenteus scotti (Lat. *cinereus*, ashy
or gray; *argenteus*, silvery; *scotti*, for W. D. Scott).

Scott's Gray Fox. Piñon Fox.

Urocyon cinereo-argenteus scotti Mearns, *Bull. Amer. Mus. Nat. Hist.*, p. 236 (1891).

Type locality.—Pinal County, Arizona.

Measurements.—Total length, 39.4; tail vert., 16.2; hind foot, 5.5.

Description.—(From a specimen taken at Coventry, Colo., Jan'y 28th) : Color above grizzled gray, many of the hairs black-tipped, especially along the middle of the back; upper half of back of ears gray, lower fulvous; chin and side of upper jaw black, except white spot at tip of latter; throat and belly white, bordered by fulvous

and an indefinite patch or band of same; front of fore legs gray, back fulvous; hind legs fulvous; tail above gray with prominent black stripe, below fulvous.

Cranial characters, see description of genus.

Distribution.—Scott's Gray Fox is found in Arizona, New Mexico, Texas, Oklahoma, Colorado, and Chihuahua, Mexico. An inhabitant of the Transition and Sonoran Zones, in Colorado it is usually found in the cedar and piñon zone, and probably does not go much if at all above 8,000 feet. While quite common in many parts of the State, we have but few county records. It has been taken in El Paso, Las Animas, Chaffee, Montezuma, and Montrose counties, and was reported as being at Lily, Routt County.

Habits.—The habits of the Gray Fox are similar in many respects to those of the Red; its food is much the same, consisting of rabbits, wood-rats, mice and such small animals, as well as any birds it may be able to catch. It has a fondness for the rocky ledges along the gulches in cañons, where it lives in holes and caves. Not very much is known of its breeding habits. A female taken April 8th, at Coventry, Montrose County, contained four small embryos which probably would not have been born for a month or more. In many places in Colorado, at least, it is called the "Swift," a name which properly belongs to *Vulpes velox*.

Genus VULPES (Lat., a fox)

Vulpes Brisson, *Regn. Anim.*, ii. ed., p. 173 (1762). Type *Vulpes alopec* Linnæus.

Revision, Merriam, *Proc. Wash. Acad. Sci.*, ii., 661-676 (1900).

Nose and jaws tapering and elongated, even more so than in *Canis*; body rather short; legs rather short; tail long, bushy; more than $\frac{1}{2}$ length of body; fur soft, hair long; nasals do not extend back to maxillaries; postorbital process concave above; temporal crests nearly in contact; skull with no frontal sinus; pupil elliptical; teeth are similar to those of *Canis* but incisors are proportionally smaller and the upper ones are not lobed; dentition identical with *Canis*—*i.e.*, i. $\frac{3}{8}$; c. $\frac{1}{4}$; pm. $\frac{4}{4}$; m. $\frac{8}{8} \times 2 = 42$.

Representatives of this genus are found in Europe, Asia, Africa, and North America, and it has been divided into

numerous species and subspecies. Some of these species range into the Arctic regions, and most of them may be said to prefer the temperate or colder climates. Some of the species furnish very fine and valuable furs, and are much sought after by hunters and trappers for this reason. Elliot's Check-list gives twenty-four species and subspecies as found in North America, of which, however, only two occur in Colorado.

KEY OF THE SPECIES

A. Larger, total length, 43.

V. macrourus, p. 237

B. Smaller, total length, 25.

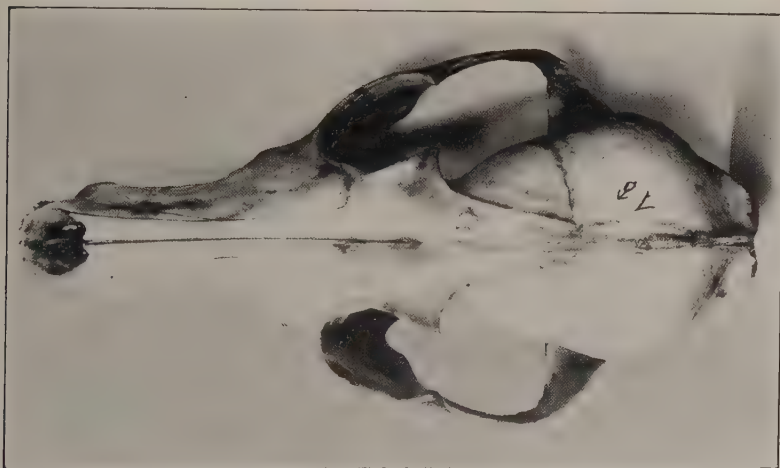
V. velox, p. 239

FIG. 76. WESTERN RED FOX, *Vulpes macrourus*
Dorsal view of skull x $\frac{2}{3}$

***Vulpes macrourus*. Western Red Fox**

Vulpes macrourus Baird, *Stans. Explor. Great Salt Lake*, p. 309 (1852).

Type locality.—Great Salt Lake, Utah.

Measurements.—Total length, 43; tail vert., 18.25; hind foot, 7.

Description.—Above reddish fulvous, darkest along median line of back and across shoulders; posterior half of back rather grizzled

by admixture of white hairs; face grayish, lightest back of eyes; ears blackish behind; sides paler than back; underparts whitish, hairs plumbeous at base, as also the under fur; chin gray, rather blackish; forelegs dark reddish fulvous, foot black in front; hind legs fulvous on outside, whitish on inside, foot black in front; tail large and bushy, mixed fulvous, black and gray, the black being on the tips of the hairs; little black on the underside of the tail; about $2\frac{1}{2}$ ins. of tip of tail white. The depth of the color of the back varies much with individuals.

Cross Phase.—(From specimen from Breckenridge, Colo., Carter Coll., in Colo. Mus. Nat. Hist., Denver): Above, from the shoulders back, gray, a mixture of black, white, and gray hairs; black stripe across shoulders; top of head similar to back; sides of muzzle blackish; back of ears black; sides of head and body fulvous; feet, legs, and underparts black; tail white-tipped; hairs of rest of tail all, or almost all, black on ends, but fulvous and gray can be seen through this. Some cross foxes have much more fulvous on back, and others less.

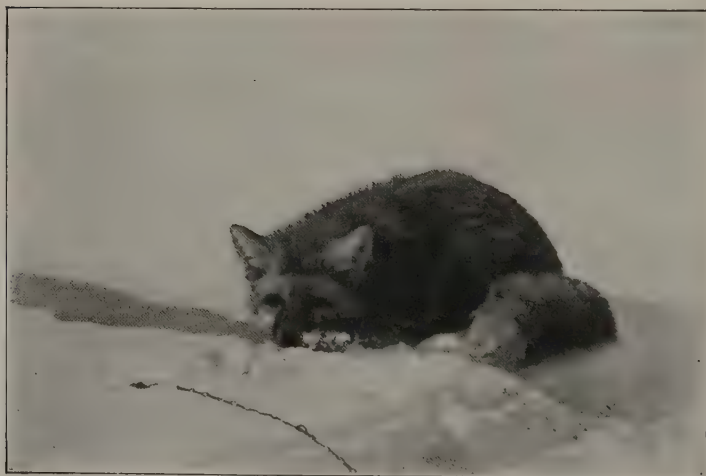


FIG. 77. WESTERN RED FOX, *Vulpes macrourus*
An individual which had been trapped and kept in captivity
several days. E. R. Warren, Photo.

Silver or Black Phase.—(From specimen from Cumbres Pass, Conejos Co., in Colo. Mus. Nat. Hist.): Above black, hairs with white tips, giving the silver-gray effect; shoulders black; top of head like back; ears and muzzle black; feet, legs, and underparts black.

Specimens of all these phases are found everywhere that the species is found, nor are they peculiar to this species but seem to be common to all the species of the Red Fox; moreover it is said that the same litter of young may contain examples of two or more of the phases.

Distribution.—Mountains in Colorado, Utah, and Wyoming. (Merriam, *l. c.*) In Colorado it does not come much below 8,000 feet, except perhaps in winter, but seems to be found all through the mountains from this altitude up to at least timber-line, where it may be found in summer and fall anyway, if not in winter.

Habits.—There does not seem to be much information at hand concerning the habits of our Red Fox. It seems to keep itself pretty much out of the way of man, coming out mostly at night, though it is sometimes seen during daytime; nor have we ever heard any complaints of it troubling the farmer's poultry. It probably lives largely on mice of various kinds, wood-rats, rabbits, such birds as it can catch, and in winter, at least, it is known to feed on dead animals, such as horses and cattle. Judging from my limited experience with them they are easily trapped, much more so than coyotes.

The young are born in April and May; the number in a litter varying from two to eight, five being the average. The male remains with the female, at least until the young are able to forage for themselves; the latter begin to come out of the dens when about six weeks old. Foxes breed during the first year, when a little less than a year old.

The black and silver fox skins are very valuable, ranging in price from \$350.00 to \$1000.00, while cross foxes vary from \$10.00 to \$20.00, and red foxes from \$5.00 to \$8.00. Because of the great value of the silver variety, some attempts have been made to breed them for their pelts, but only on a very small scale as yet.

Vulpes velox (Lat., swift). Swift Fox

Vulpes velox Say, *Long's Exped. to Rocky Mts.*, i., p. 487 (1823).

Type locality.—This seems to be somewhat doubtful. The

description is in a footnote following mention of "Cherry Creek," which seems to be Pawnee Creek, Logan Co., Colo. The description was drawn up from parts of two or three different animals, and does not say where they were taken; the animal was seen by the expedition both in what is now western Nebraska and eastern Colorado.

Measurements.—(From Elliot): Total length, 25.5; tail vert., 8.9; hind foot, 3.75.

Description.—Above pale grizzled gray; sides pale yellowish fulvous; belly white; top of head and ears more fulvous; tail grayish, somewhat grizzled above, clearer below, about $1\frac{1}{2}$ ins. of tip black.

Distribution.—The Swift is found on the plains north from Texas to the Saskatchewan Plains, Canada; it is found in Colorado on the plains east of the foot-hills, but does not seem to be abundant anywhere.

Habits.—This species lives on the prairies, using burrows excavated by some other animal such as the badger, or possibly at times digging holes for itself. It feeds on the smaller animals inhabiting those regions.

Genus CANIS (Lat., a dog)

Canis Linnæus, *Syst. Nat.*, 10th ed., i., p. 38 (1758). Type *Canis familiaris* Linnæus.

Nose long, tapering; jaws elongated; postorbital processes short, smooth, convex; brain-case lengthened, compressed anteriorly; nasals extending to or back of maxillaries; a strong sagittal crest; angular process of lower jaw long and curved; skull with frontal sinus; tail rather bushy; pupil round; dentition: i. $\frac{3}{5}$; c. $\frac{1}{1}$; pm. $\frac{4}{4}$; m. $\frac{3}{3} \times 2 = 42$; a projection or lobe on each side of and above point of upper incisors; upper carnassial tooth with middle lobe conical, pointing backward, anterior lobe nearly obsolete; lower carnassial or first molar very large, with bilobed blade, compressed, the hinder lobe the larger, with two cusps and a raised anterior border; second lower molar small, and the last very small; first upper molar large, second smaller, but of good size; first lower premolar small, about the same size as the last lower molar.

This genus is cosmopolitan, representatives being found on every continent. It comprises the Dogs, Wolves, Coyotes, and Jackals. A considerable number of species of the various forms or groups have been described, but many of

these are doubtless of uncertain validity. In North America are the large Gray or Timber Wolves, and Coyotes or Prairie Wolves, both of which have been divided into several forms, four for the wolves, and fourteen for the Coyotes in Elliot's Check-list, which however are often difficult to separate from one another, or to describe so that they can be separated. To Colorado however, but one species of the large wolf has been ascribed, while there appear to be several forms or varieties of the coyote, whose relationships and standing can hardly, at the present writing, be defined.

***Canis nubilus* (Lat., cloudy). Gray Wolf**

Canis nubilus Say, *Long's Exped. Rocky Mts.*, i., p. 169 (1823).

Type locality.—Vicinity of Council Bluffs, Pottawattamie County, Iowa.

Measurements.—Total length, 54; tail vert., 11.

Description.—Gray on the back, many of the hairs black-tipped, making irregular wavy black markings, which are heaviest in the middle of the back; the under fur is dusky; sides and underparts whitish gray, palest beneath; face gray; ears rather fulvous; tail gray with black markings similar to those of the back; outside of legs somewhat fulvous, inside like underparts. Wolves vary much in color, especially in the amount of the black on the back.

Distribution.—At the present writing I have no information which will enable me to separate the range of *Canis nubilus* from that of the other forms of the Gray Wolf, but in Bailey's "Wolves in Relation to Stock, Game, and the National Forest Reserves," *Forest Service Bulletin No. 72*, wherein will be found much information about the habits of wolves, is a map showing the distribution of wolves through the United States, and from this it appears that wolves are found from the western portion of the Dakotas, Nebraska, and Kansas westward to the middle of Utah and Arizona, and on the north clear to the Arctic Ocean, and are also found on the islands in that ocean north of the North American continent; California and Nevada are, however, wanting in wolves, except in the extreme northeast corner of the latter State. Wolves are found all through Oklahoma and Indian Territory; over most of Texas, Arkansas, Louisiana, Mississippi, Alabama, Georgia, and Florida. They are also along the line between Tennessee and North Carolina; likewise in northern Minnesota and Wisconsin, and in the northern peninsula

of Michigan. They also range over much of Canada to the Arctic Ocean, and are also inhabitants of the tableland of Mexico.

Wolves seem to be found all over Colorado, though, from what Bailey says about their habits in Wyoming, they may move down from the higher elevations at the approach of winter. But wherever I have been in the State I have heard of the presence of wolves, in greater or less abundance, and I doubt if there is a county in the State, with the possible exception of Denver, which has not at least a few wolves within its limits, and Denver has some in confinement in the City Park.

Habits.—From time immemorial wolves have been noted for their ferocious and predaceous habits, preying alike on wild animals and on the domesticated stock of mankind, so that the name wolf has become associated with savageness and ferocity. In this country they have these traits, and ever since America has been settled, wolves, wherever found, have been enemies to the farmer until exterminated, or their number so reduced that they were practically harmless, for they have been exterminated in some of the oldest settled regions of the country.

In the western country, before its settlement, and before the extermination of the buffalo, the wolves on the plains were largely dependent on the herds of the latter animals for their support, hanging around them, picking up calves, and wounded and decrepit animals. Since the disappearance of the buffalo the wolf has turned its attention to the white man's cattle, and has proved very destructive, and not only that, but has in many localities increased in numbers. Wary and hard to trap or shoot, and bringing forth from five to thirteen young every year, they are well able in thinly settled districts to hold their own against man. Their rutting season is in January and February, and the young are born in April and May, the period of gestation being nine weeks, as in the case of the dog. As stated above, the litters are large, five to thirteen, eight to eleven being the usual numbers. The young are born in dens, which are caves or

holes among rocks, in washed-out cavities in the bad lands, or in old badger holes that have been enlarged by the wolf. The pups remain at or near the dens until they are two or three months old. In the spring of 1907, in the Green River Valley, and along the east base of the Wind River Mountains in Wyoming, 12 wolf dens were discovered and raided, and 70 pups found therein. This was done by the cattlemen and forest rangers, the latter having been instructed to hunt for and destroy all the wolves possible. It is by finding the dens and killing the young wolves that the best work in keeping down their numbers is done. Both parents aid in bringing up the young, the male hunting food for them as well as the female. Their food consists of almost anything, from rabbits up, and they occasionally catch the different species of grouse which live in their range. In Colorado and other parts of the West, probably but few deer, antelope, or elk are destroyed by wolves, but in some other parts of the United States and Canada many deer, caribou, and some moose are killed by them, while in the very far North musk ox are their prey. Cattle are the stock usually killed by wolves, and grown animals as well as calves and yearlings are killed, though the latter are the usual victims. The usual method of attack is from the rear, the wolf biting and tearing great pieces from the flanks of the victim, and many more cattle are killed than are eaten, as the wolf seldom goes back to its kill for a second meal, except when food is very scarce. Some cattlemen estimate the loss from cattle killed by wolves as high as ten per cent. annually. A good many colts and some full-grown horses are also killed by wolves, the comparative immunity of the latter being explained by the fact that they can defend themselves from a rear attack with their heels. Sheep are also attacked when not herded, but as in the western States it is the almost invariable practice to herd the sheep, the loss from wolves is comparatively small. Of course

any unguarded domestic animal is liable to be attacked. I obtained some very interesting information illustrative of the destructiveness of a wolf while in Routt County. In the western part of that county, in and near the Escalante Hills, there was killed early in June, 1907, a wolf locally known as "Old Clubfoot," this name being given because it had lost two of its toes in traps, so that its track was easily recognized about the kills. This wolf had become so destructive that one cattleman had offered an extra bounty for it, in addition to those paid by the county and by the cattlemen's association. This man, John Chew, whose son trapped the wolf, said that the tracks of Clubfoot had been seen about the freshly killed carcasses of some seventy-five head of cattle and horses, and that of these he himself had lost thirty head. He further said that since that wolf had been killed, about two weeks previous to our conversation, no stock had been killed by wolves. Of course the tracks of other wolves had been seen about the slaughtered animals, but the fact that Clubfoot's tracks were always so much in evidence seemed to point to the conclusion that he was the leading spirit in this work. That he was a large, old animal is evidenced by the skull which is now in my collection.

Some idea may be obtained of the abundance of wolves and coyotes from the reports of the forest supervisors of the wolves and coyotes killed in or near the national forests in 1907. This is taken from *Biological Survey Circular* No. 63. The figures are as follows:

<i>State</i>	<i>Wolves</i>	<i>Coyotes</i>
Wyoming	1,009	1,983
Montana	261	2,629
Idaho	14	3,881
Washington	10	675
Colorado	65	2,362
Oklahoma	3	15
New Mexico	232	544

<i>State</i>	<i>Wolves</i>	<i>Coyotes</i>
Arizona	127	1,424
Utah		5,001
Nevada		500
California		224
Oregon	2	3,290
Total	1,723	22,528

In Colorado, at least, a good many of both species were killed which are not included in this list; many are hunted and destroyed on the plains in the eastern part of the State, away from any of the forest reserves, and this is especially true of the coyotes, many of which are killed in this portion of Colorado. In Wyoming, in the eleven years from 1895 to 1906, both inclusive, bounties were paid for 20,819 wolves. In Minnesota, from 1896 to 1904, both inclusive, bounties were paid on 29,348 wolves and coyotes, no distinction being made between the two in that State. I have thought it worth while to give these figures, as they show, better than any other way that I can express it, how many of these animals there are in our Western States, and how, being in such numbers, they can be great enemies to the stock-growing interests.

***Canis nebrascensis.* Nebraska Coyote**

Canis nebrascensis Merriam, *Science*, N. S., viii., p. 782 (1898).

Type locality.—Johnstown, Brown County, Nebraska.

***Canis lestes.* Robber Coyote**

Canis lestes Merriam, *Proc. Biol. Soc. Wash.*, xi., p. 25 (1897).

Type locality.—Toyabe Mountains, near Cloverdale, Nye County, Nevada.

***Canis frustror* (Lat., to frustrate, make in vain). Tricky Coyote.**

Canis frustror Woodhouse, *Proc. Acad. Nat. Sci. Phila.*, v., p. 147 (1851).

Type locality.—Fort Gibson, at the junction of the Neosho River with the Arkansas, Indian Territory.

Canis mearnsi (for Dr. E. A. Mearns). Mearns's Coyote.

Canis mearnsi Merriam, *Proc. Biol. Soc. Wash.*, xi., p. 30 (1897).

Type locality.—Quitobaquita, Pima County, Arizona.

Canis estor (Lat., eater, a glutton). Desert Coyote

Canis estor Merriam, *Proc. Biol. Soc. Wash.*, xi., p. 31 (1897).

Type locality.—Noland's Ranch, San Juan River, San Juan County, Arizona.

Because of the difficulty of separating, with the material at hand, the different forms of Coyotes supposed to occur in Colorado, and of preparing descriptions of them, as well as defining their ranges, it has been deemed best to list as above all those which are known to or are supposed to inhabit our State. The following description will serve in a general way for all.

Measurements.—Total length, 48.0; tail vert., 14.5; hind foot, 8.0; ear, 5.5. These from a male taken at Crested Butte. Its weight was 25 pounds.

Description.—Coyotes are so well known that it hardly seems worth while to write a description of the animal, especially as they are so variable in color that it is impossible to make a description which will serve for every individual.

In a general way they may be said to be grizzled above, with a more or less distinct black dorsal stripe posteriorly, and much of the hair of the rest of the upper parts is black-tipped. The color of the upper parts, aside from the black, varies from grayish to tawny or fulvous, depending on individuals, locality, and season; the muzzle and back of ear is some shade of fulvous or buff; the under parts are whitish; the tail is more or less like the back.

It is principally on the cranial characters that the differences between the various forms of coyotes are based, and very large series of skulls from every part of the State must be collected, studied, and compared before any definite conclusions can be arrived at.

Distribution.—Coyotes are or were found over much of the western country from the Mississippi River westward to the Pacific

coast, and from Alberta south into Mexico. They are found in every part of the State of Colorado, from the plains up into the mountains to or above timber-line. *Nebrascensis* is a plains form, but may be replaced in the southeast corner of the State by *frustror*, as certain Baca County specimens seem to belong to that form. If *estor* is in the State at all it will be found in the extreme southwest portion. The other two, *lestes* and *mearnsi*, are mountain and foot-hill forms.



FIG. 78. COYOTE IN TRAP

Rob't B. Rockwell, Photo.

Habits.—Coyotes, instead of decreasing with the advance of civilization and settling up of the country, seem to increase and actually thrive under those conditions. As a consequence the animals are as numerous in the West as they ever were. Living as they do in all the life zones from Boreal down into portions of the Tropical, they have shown themselves adaptable to all circumstances. It is possible that in Colorado those forms which live at the highest elevations may make a limited vertical migration, going to a somewhat

lower altitude in winter, but this movement cannot be very great, for the animals winter at least as high as 10,000 feet. This vertical migration may of course result in the mingling of two different forms for a time.

Coyotes have long been noted for their peculiar howling, which possesses a ventriloqual quality which gives the hearer the impression that instead of listening to one animal he hears half a dozen or more. While they usually howl only at night, they are sometimes heard during the day. One winter in Gunnison County, the coyotes used invariably to howl in the daytime, before a storm. Then during the storm they seemed to remain quiet, and probably kept in their dens until the storm was over; then the first clear night after the weather cleared the howling would be heard again, and next morning their tracks seen on the snow.

As with the wolves, coyotes breed but once a year, mating in January and February, while the young are born in late March or in April. In June they come out around the burrows, and by August are left to shift for themselves. The young are born in dens, which may be holes of badgers or other animals enlarged by the coyote, or holes among rocks or washed-out places in the banks of streams or gulches. The number of young in a litter is from four to eight or more.

The food of coyotes is of course mainly animal, but they are known to eat vegetable food also; this is usually fruit of some kind; in Colorado they have been known to eat water-melons, in California peaches, apricots, and grapes. There they sometimes eat juniper, manzanita berries, and the fruit of the prickly pear (*Opuntia*) as well. Their animal food is practically anything they can get, from the flesh of the largest animals down to mice; birds, reptiles, fish, and crustaceans are also eaten. In their food habits coyotes are in many ways beneficial; they kill many prairie-dogs and rabbits, both cottontails and jack rabbits, and the latter

especially are pests in many sections. Two or three coyotes sometimes unite to catch a jack rabbit, which they are unable to run down. They do this by taking turns in driving the rabbit and taking advantage of the latter's tendency to run in a circle, and heading it off on the turns. Coyotes also catch many kangaroo rats, wood-rats, various species of ground-squirrels, woodchucks, voles, pocket-gophers, and various other small rodents, many of which are at times, at least, injurious to man. It also acts as a scavenger by eating carrion, even coming into the small towns at night to eat garbage; in fact I have seen them at the garbage heaps just outside a small town in the middle of the day.

Coyotes kill many ground-haunting birds, the various grouse and quail are captured by them, and in the breeding season many eggs are eaten; wild ducks are also captured by them when on the land, either nesting or ashore and wounded, unable to fly. They have been known to kill deer and antelope, several hunting together in much the same manner as they do rabbits, and relieving one another, and also taking advantage of the tendency of the game to run in circles.

Poultry of all kinds is taken by coyotes when opportunity offers; the young of all the domestic animals fall victims to the coyote, calves, pigs, lambs, goats, and sometimes colts; sometimes older animals are killed, such as yearling cattle. They are especially enemies to the sheep industry, as they are able to kill both sheep and lambs, and do much damage in the flocks. Losses to the sheep industry are estimated in various places from five to twenty per cent.

We have already given, when speaking of the wolves, some figures regarding the numbers of coyotes killed in certain States. In Kansas, from July 1, 1903, to June 30, 1904, bounties were paid on 19,514 coyotes. These figures give some idea of the numbers of the animals.

Coyotes, when caught young, may be readily tamed, and

make interesting pets. One quite frequently sees them about ranches thus tamed. An old coyote was seen by me on the bank of the Snake River, near Lily, Routt County, having a game all by itself. The animal was at first observed at some little distance away, apparently acting in a very peculiar manner. On taking advantage of some trees and approaching closer, the coyote, which was on the opposite side of the river, was seen to be playing. It would run along the shore, pick up a stick in its mouth, shake it and run along with it, playing much as a puppy does, but this was a full-grown coyote; it was too early, July first, for the young to be about, and besides they would not have grown as large as that one by that time. Finally the coyote saw that he was being observed, and promptly took his departure.

Recently I saw something very interesting and rather puzzling. While driving with a friend toward Silver Cliff, and a mile or two outside the town, two coyotes suddenly came over a little rise, trotting along in single file, and 25 or 30 yards from the road. A few yards behind and following them was a badger. The animals paid but little attention to us until the cart was stopped, when the coyotes ran off, the badger following in their tracks. A hundred yards or so away the coyotes stopped and watched us a minute or two, then turned and trotted slowly off, the badger still following.

I have been told of something similar on the plains of eastern Colorado, a friend having told me that he had seen a coyote and a badger apparently in company several times, and that they seemed to be hunting together. Of course there is a beautiful opportunity here to enlarge upon the association of the two animals, and theorize upon the fact that a partnership had been formed, with the understanding that the coyote would chase the game into a hole, and the badger dig it out, and then the spoils were to be divided. But I decline to take the responsibility of any such theories.

Where these three animals were seen by me prairie-dogs were common, the young only three quarters grown, a nice morsel for a badger, and easy for him to dig out, so that he had no need for partners, though no doubt the coyotes would have found him useful in getting prairie-dogs for them, provided he was willing to do so.

Family FELIDÆ

This family comprises the cats and their allies. These are digitigrade carnivora with the fore limbs with five and the hind limbs with four toes; the claws borne by these are strongly curved, compressed, sharp and retractile; skull and head short and round. Other characteristics: auditory bullæ dilated, rounded, smooth, thin-walled, and divided into two chambers; auditory meatus short; paroccipital process applied to and spread over the bulla; mastoid process not much developed; carotid canal small and inconspicuous; condyloid and glenoid foramina concealed or wanting; cæcum small. Dentition: i. $\frac{3}{3}$; c. $\frac{1}{1}$; pm. $\frac{2 \text{ or } 3}{2}$; m. $\frac{1}{1} \times 2 = 28 \text{ or } 30$; the most remarkable tooth is the last premolar of the upper jaw, which, with the solitary molar of the lower, forms a pair of sharp-cutting blades acting like scissors and termed the carnassials; the solitary upper true molar is small and placed transversely; the canines are large and strong and the incisors small and weak.

KEY OF THE GENERA

- A. Ears tufted; tail short, less than half the length of the body without head; two upper premolars only. **Lynx**, p. 251
- B. Ears not tufted; tail long, exceeding half the length of the body without head; three upper premolars. **Felis**, p. 255

Genus LYNX (Latin name of animal)

Lynx Kerr, *Anim. Kingd.*, i., p. 32; desc. p. 155 (1792). Type *Felis lynx* Linnæus.

Claws completely retractile; cranial characters as in *Felis*; tongue rough as in that genus; dentition: i. $\frac{3}{5}$; c. $\frac{1}{1}$; pm. $\frac{3}{5}$; m. $\frac{1}{1}$; $\times 2 = 28$, the small anterior upper premolar being absent. The limbs are long; tail short and stumpy, less than half the length of body without head; color light brown or gray; more or less spotted with a darker shade; ears tufted, hair on cheeks long.

The members of this genus are found in the northern parts of the New and Old Worlds; Flower and Lydekker admitting four species in Europe and Asia, while Elliot, in his Check-list, gives sixteen species and subspecies as occurring in North America, ranging from northern Mexico to 60° north latitude.

KEY OF THE SPECIES

- A. Feet very large, paws 10 or more in circumference; tip of tail black all round. **L. canadensis**, p. 252
- B. Feet not so large, circumference of paws 7-8; terminal black mark on tail is a *crescent on the upper side*.
 - a. Tail with one blackish and one fulvous band in front of black tip; skull comparatively broad, zygomata widely spreading. **L. baileyi**, p. 253
 - b. Tail with two or three blackish bands on upper surface in front of black tip; skull relatively long and narrow, with well-developed sagittal crest. **L. uinta**, p. 255

Lynx canadensis. Canada Lynx

Lynx canadensis Kerr, *Anim. Kingd.*, i., p. 157 (1792).

Type locality.—Canada.

Measurements.—(Carter, specimen from Breckenridge, Colo.): Total length, 37; tail vert., 4.75.

Description.—Body stout, and legs very long, with very large feet. The fur is dense and very long. Color light gray, base of hairs rufous, giving a reddish tinge to the coat; top of head and back darkest; ears behind black with a gray patch, and tufts of black hairs projecting upwards from the tips; under parts white; tip of tail black all round.

Distribution.—The Canada Lynx is an inhabitant of the Boreal Zone, and is found from the tree limit in northern British America south to Maine and the northern tier of the United States, and in the Rocky Mountains south through Colorado, possibly into northern New Mexico. It is probably also found in the other high ranges to the west, but we have no information at hand on this point. In

Colorado it is found only in the highest parts of the timbered mountains, and seems to be generally distributed through the State within these limits, but nowhere particularly common. There is a specimen in the Colorado Museum of Natural History at Denver, which was taken near Breckenridge, Summit County.

Habits.—As intimated above, the Canada Lynx is a forest dweller, and makes its home in the heavy timber of our high mountains. We have heard but little about its habits in this State, but they are well known in the north, where many generations of hunters and trappers have been taking them for their fur. MacFarlane says that "in the Mackenzie River District the lynx feeds on eggs, ducks, grouse, mice, stranded fish, and occasionally on a land-captured beaver, young deer, or sheep, while rabbits, of course, form their staple article of diet." He says the flesh is white and tender, and much relished by the native and other inhabitants of that region.

From two to six young are said to be born in a litter and they are brought forth in May or June.

Lynx baileyi. Bailey's Bobcat

Lynx baileyi Merriam, *N. A. Fauna*, No. 3, p. 79 (1890).

Type locality.—Moccasin Spring, Coconino Co., Arizona.

Measurements.—(Of type from Merriam): Total length, 29.25; tail vert., 5.25; hind foot, 6.5; ear from crown (dried skin), 2.35. A specimen from northwest corner Baca County, Colorado, very old female, total length, 30.25; tail vert., 5.75; hind foot, 6.70. Three males, Graham Co., Arizona, 33, 5.75, 7.

Description.—(From the above mentioned Baca County specimen, which was taken May 22d, and is in a rather worn faded pelage): Color above, buffy, mixed with some white-tipped hairs, and along back with some black-tipped hairs, making that portion distinctly darker; upper part of back of ears and spot at base black, the space between these two areas being gray; small tuft of black hairs on ear; top of head and face like rest of upper parts; a buffy pectoral band; chin white; rest of under parts white and buffy, with indistinct black spots or markings; under parts of feet blackish; insides of legs spotted or marked with blackish; under part of tail whitish; upper part like back, with terminal black crescent on tip and an

indistinct blackish band in front of it, the two being separated by a fulvous band.

Only one skull of this species is at hand, that of the before mentioned Baca County specimen. Its special characteristics seem to be its size, compared with the size of the animal, being as long as a skull of female *uinta*, which animal measured an inch more in total length, while the width of the palate and across the zygomata are proportionately much greater. The skull is flatter across the frontals and the postorbital processes do not slant as sharply downward as in the *uinta* skull. The brain-case seems somewhat narrower than in the *uinta* specimen. The wide-spreading zygomata give the whole skull a broad squarish appearance.

Distribution.—Our knowledge of distribution of Bailey's Bobcat is somewhat indefinite; it seems to be found in Arizona, New Mexico, Texas, Colorado and probably in Oklahoma. The only positive Colorado records at present are Gaume's Ranch, in the northwest corner of Baca County, and Mesa de Maya, Las Animas County.

Habits.—The two species of Bobcats found in Colorado have very similar habits. They are generally found making their homes around rocky places where there are holes and crevices for dens. From these places they start out at dusk in search of prey, which consists of rabbits, wood-rats, mice, and birds they may be able to surprise—in fact, almost any animal not too large for their strength. No doubt they do occasionally pick up a young lamb, and they every now and then make a raid on a poultry yard. I know of such a case where the raider trapped himself nicely. The chickens were in a small frame building which had once been used for a dwelling and had a hole cut in the roof for a stove-pipe. The cat got into the house through this hole, killed all the chickens, some 25 or 30, and then could not get out the way he came in, and had to wait for the owner to come in the morning and pay the penalty of his crime. Still it is quite likely that these cats are really beneficial to man on the whole, as they must kill a great many small harmful animals, and poultry killings are comparatively infrequent. They are cowardly animals, and easily treed by almost any kind of a

dog without showing fight. Not much seems to be known about their breeding habits.

Lynx uinta. Mountain Bobcat

Lynx uinta Merriam, *Proc. Biol. Soc. Wash.*, xv., pp. 71-72, March 22, 1902.

Type locality.—Bridger Pass, south slope Uinta Mountains, Uinta Co., Wyoming.

Measurements.—Male: total length, 36.5; tail vert., 6.5; hind foot, 7.25. Female: total length, 31.5; tail vert., 5.75; hind foot, 7.25.

Description.—In color this Bobcat is rather variable, some specimens being much grayer than others; but the usual type of coloration is, above, buffy, much grizzled with gray and black, the latter color being most prominent on middle of back and on shoulders, but there are no distinct spots or other markings above; the under parts are white with black spots, which become bands on inner sides of fore and hind legs. A large black crescent or spot on upper half of end of tail, and two or three blackish or fulvous bands in front of this black spot. Edge of back of ear black, then gray for about half the height of the ear, whose lower half is buffy like back. Comparatively little black on under surface of feet. The skull of a female of this species has already been mentioned in comparison with that of *L. baileyi*. It is that of a fully grown animal, though not as old as that of the species it was compared with. Several skulls of males of *L. uinta* are at hand. These are essentially alike in their characteristics and present much the same features as in the case of the female, except that they are larger; but for a cat they are relatively long and narrow with the postorbital process sloping abruptly downward.

Distribution.—The Mountain Bobcat is found in Utah and Colorado and very likely in Wyoming and New Mexico, but we have no information on that point. In Colorado it seems to be found from the eastern base of the mountains westward. It has been recorded from El Paso, Teller, Grand, Routt, Rio Blanco, Gunnison, Chaffee, Custer, Delta, Montrose, and San Miguel counties. It ranges high in the mountains, to 10,000 feet or more.

Genus FELIS (Lat., a cat)

Felis Linnæus, *Syst. Nat.*, 10th ed., i., p. 41 (1758). Type *Felis leo* Linnæus.

Revision (of *Felis concolor* group), Merriam, *Proc. Wash. Acad. Sci.*, iii., pp. 577-600 (1901).

Claws completely retractile; soles hairy, pads naked; tail long; tongue rough, covered with horny papillæ pointing backward; skull short and broad; facial portion short; zygomata very wide, arched; bullæ large, smooth; dentition: i. $\frac{3}{3}$; c. $\frac{1}{1}$; pm. $\frac{3}{3}$; m. $\frac{1}{1} \times 2 = 30$.

For the purposes of this book this genus is restricted to the long-tailed cats, having the small anterior upper premolar, which comprises many species found in many parts of the world. Of these only one, *Felis hippolestes*, the Mountain Lion or Cougar, is found in Colorado, while it and its related forms, the various species and subspecies of *Felis concolor* and its allies, are found throughout North and South America. The Jaguar, *F. onca*, has been taken in Texas and New Mexico, while two or three smaller species of long-tailed cats have been taken in Texas and along our Mexican boundary.

Felis hippolestes (Grk. *hippos*, horse, + *lestes*, thief).

Rocky Mountain Cougar. Mountain Lion.

Felis hippolestes Merriam, *Proc. Biol. Soc. Wash.*, vi., p. 219, (1897).

Type locality.—Wind River Mountains, Wyoming.

Measurements.—(Of type taken from well made skin, by Merriam): Total length, 102; tail vert., 36.5; hind foot, 10.6. Those taken by Mr. Roosevelt in Rio Blanco County varied in total length, from 8 feet to 7 feet 6 inches for males, and from 6 to 7 feet for females. The largest male weighed 227 pounds.

Description.—(Of type from Merriam): Upper parts and sides pale fulvous brown, darkest in middle of back and tail; tip of tail black; face from nose to eyes grayish brown; a pale patch over each eye; back of ears blackish; chin, lips (except dark patch at base of whiskers), throat, breast, inner side of forelegs, inguinal region, and hinder part of belly soiled white; underside of tail grayish white.

Distribution.—This species is the form of Cougar inhabiting Montana, Wyoming (the type locality), Colorado, New Mexico, and possibly Utah, Nevada, and Idaho, and according to Preble, *N. A. Fauna*, No. 27, it is found in British America, on the Athabasca River, as far north as Lat. 56°. In Colorado it is distributed more or less commonly from the foot-hills west to the Utah line. It may

also be found in the eastern part of Las Animas County, much of which is rough and broken country and an excellent place for an animal of its habits, but as yet we have no information as to whether it is there or not.

The species ranges quite high in the mountains, to above 10,000 feet, but is probably most abundant in the western part of the State, in Rio Blanco and Routt counties.

Habits.—The Mountain Lion is an animal of predaceous habits, living on flesh, which it prefers to procure for itself rather than to take carrion which it finds ready to hand. This food varies from animals as large as colts, deer, and young elk, down to rabbits, and very likely wood-rats and such small fry when pressed by hunger. Where game is abundant it is very destructive to both the elk and deer. In the Yellowstone National Park and in Jackson Hole, Wyoming, it kills elk in winter by lying in wait on shelves in the cliffs and bluffs along the valleys above the trails on which the animals travel, and leaping down upon its victim, which is usually a calf or yearling. Many elk are thus destroyed during the winter in these localities. So great have been its depredations in the Yellowstone Park that hunters have been employed by the government to kill the lions to preserve the elk.

Horse flesh seems to be very attractive to this animal and many colts fall victims to their taste for this sort of food, and in some localities serious loss has been caused by the lions. Cattle do not seem to suffer so much, but are killed to a certain extent.

The breeding season seems rather indefinite, or at least is spread over quite an interval of time, judging from the notes obtained by Mr. Roosevelt in Rio Blanco County. He killed a mating pair January 28th; January 15th he captured the mother of three small kittens, apparently three or four days old; January 31st a female was killed which contained three foetal young, which would have been born in a few

days; and on "February 8th one was taken containing three young which would have been born in a month or six weeks." A female was also killed February 12th, which appeared to be nursing its last year's kittens, which was killed at the same time.

ORDER INSECTIVORA

This order contains various families of small mammals, without much external resemblance to one another, and united to one another chiefly by their inferior organization and by the absence of specialization shown in their structure. The greater number of these agree in having a pointed snout projecting considerably beyond the lower jaw; they have usually five toes provided with claws and are plantigrade or subplantigrade; their bodies are covered with soft fur or spines; their molars have projecting cusps and their canines are small and weak, the distinction between the incisors, canines, and premolars being generally not so well marked as in the other orders of mammals.

Among the more important anatomical characters are the following: Clavicles present (in all Colorado forms); cerebral hemispheres smooth and not projecting backwards to conceal the cerebellum; testes abdominal or inguinal, not received into a scrotum; uterus two horned, and placenta discoidal and deciduate.

Out of ten recognized families only two are represented in the Colorado fauna.

KEY OF THE FAMILIES AND GENERA

- A. Subterranean forms with stout bodies; limbs modified for digging, and short tails, less than $\frac{1}{4}$ total length (*Talpidae*). Scalops, p. 259
- B. Terrestrial or aquatic mouse-like forms, with long tails, at least $\frac{1}{4}$ total length (*Soricidae*).
 - a. Terrestrial; feet without a fringe of long hairs. Sorex, p. 261

- b. Aquatic; feet with a fringe of long, bristle-like hairs.

Neosorex, p. 266

Family TALPIDÆ

Insectivora of moderate size, of subterranean habits, and small eyes and ears, and with the fore limbs more or less modified for digging; skull with a zygomatic arch and auditory bullæ; first upper incisor much larger than the second, unicuspidate, and not extending horizontally forward.

A small family of North American moles.

Genus SCALOPS (Grk., a mole)

Scalops Illiger, *Prodr. Syst. Mamm. et Avium*, p. 126 (1811).
Type *Sorex aquaticus* Linnæus.

Animals with robust body; short tail; short legs; front feet very large, broad and adapted for digging; fore and hind toes webbed; fur soft and thick; skull long, narrow, and flat; brain-case large; palate broad; dentition: i. $\frac{2}{3}$; c. $\frac{1}{1}$; pm. $\frac{3}{3}$; m. $\frac{3}{3} \times 2 = 40$; functional dentition: i. $\frac{3}{3}$; c. $\frac{1}{1}$; pm. $\frac{3}{3}$; m. $\frac{3}{3}$; $\times 2 = 36$; first upper incisor large, next two minute.

The moles are animals of exclusively underground habits, rarely seen on the surface, but living in their burrows, which they extend in various directions in their search for food, throwing up mounds of earth here and there. They are exclusively of carnivorous habits, earthworms being their chief food, though they will eat any kind of flesh. It is stated that if two are confined in a cage without food the stronger invariably devours the weaker.

The short fore legs with the wide naked hands and palms turned outwardly are admirable instruments for digging. The short velvety fur almost entirely hides the eye, and the ear has no conch. They have from five to six young, and the period of gestation is about six weeks. In North America no moles have been found south of Mexico, and the present genus is exclusively North American, including, according to Elliot's Check-list, two species and four subspecies, one of which is found in eastern Colorado.

Scalops aquaticus machrinus (Lat. *aquaticus*, aquatic;
Grk. *makros*, large + *rhin* (*rhin*), nose). Large-Nosed
Mole. Western Silvery Mole.

Talpa machrina Rafinesque, *Atlantic Journ.*, i., p. 61 (1832).

Type locality.—Near Lexington, Fayette County, Kentucky.

Measurements.—Total length, 7; tail vert., 1.25; hind foot, 0.8.

Description.—Above brown, with grayish shades; according to the manner in which the light strikes the hair, it may appear dull or bright and silvery; the under parts are a trifle paler in color; tail naked, both it and the feet yellowish in dry skin, white in life.

Cranial characteristics as for genus.

Distribution.—Wisconsin and Minnesota to Tennessee and Missouri, west to eastern Kansas, Nebraska, and southwestern South Dakota. There is a single Colorado record, from Wray, Yuma County, where it seems rather common from reports received.

Habits.—The habits have been sufficiently described under the description of the genus.

Family SORICIDÆ

Small terrestrial or rarely aquatic mouse-like insectivores with long projecting muzzles, hairy bodies, and well-developed tails usually covered with short hairs but not bushy; skull long and narrow without zygomatic arch or postorbital processes, and the tympanic bone remaining ring-like, not forming a bulla; first upper incisor large and hook-like with a basal cusp; a number of small teeth closely resembling one another between this and the molars represent the other incisors, canines, and premolars; upper molars three in number, with their cusps arranged in a distinct W.

This family is an extensive one, including more than half the representatives of the order; its distribution is coextensive with that of the order, being spread all over the temperate and tropical regions of both hemispheres, except South America and Australia.

Genus SOREX (Lat., a shrew)

Sorex Linnæus, *Syst. Nat.*, 10th. ed., i., p. 53 (1758). Type *Sorex araneus* Linnæus.

Revision, Miller and Merriam, *N. A. Fauna*, No. 10 (1895).

Animals of very small size; long tails; soft fur; feet without fringe; skull small, delicate; brain-case broad; dentition: i. $\frac{4}{3}$; c. $\frac{1}{0}$; pm. $\frac{2}{1}$; m. $\frac{3}{8} \times 2 = 32$; inner sides of canines and incisors without secondary cusps.

The members of this genus are found in the temperate and subarctic portions of Europe, Asia, and North America. They are very small animals, frequenting meadows, marshy places, and woods. Their food is largely though not entirely insectivorous, and for their size they are extremely savage and voracious animals. On their bodies are glands which secrete a fluid having a disagreeable odor, which is a cause of their bodies being rejected as a food after they have been killed by animals or birds of prey. The young are born blind, naked, and toothless.

They have two pelages called winter and summer, though the moults are somewhat irregular and do not correspond exactly with these limits. In studying and identifying the species it is absolutely necessary to examine the cranium and teeth, as the colors of some of the species are very similar and the differences hard to define. The most important dental characters are the size and depth of emargination of the molariform teeth and the proportions of the unicuspidate teeth. It is also quite necessary, when possible, to have skulls of approximately the same age for comparison, because of changes in the shape of the skull which take place with age, and in the teeth resulting from wear. The skull becomes broader, shorter, and flatter, the molars wear so as to appear broader, and the long middle incisors not only wear off in front but turn down at a right angle to the cranial axis.

Many species and subspecies have been described in the

genus, Elliot's Check-list giving thirty-five species and fifteen subspecies as found in North and Middle America, four of which have been met with in Colorado.

KEY OF THE SPECIES

- A. Third unicuspid larger than fourth. Size small; tail about 1.6; usually less. **S. personatus**, p. 262
- B. Third unicuspid smaller than fourth.
 - a. Hind foot about 0.5.
 - a'. Tail usually 1.75 or more; third unicuspid much smaller than fourth; ears inconspicuous; palate broad. **S. obscurus**, p. 264
 - b'. Tail usually less than 1.75; palate narrow; ears larger; anterior part of rostrum attenuate. **S. vagrans dobsoni**, p. 264
 - b. Hind foot decidedly less than 0.5; brain-case low, flat, and narrow. **S. tenellus nanus**, p. 265

Sorex personatus (Lat. assumed, masked). Masked Shrew

Sorex personatus Geoffroy Saint Hilaire, *Mém. du Muséum*, Paris, xv., pp. 122-125 (1827).

Type locality.—Eastern United States.

Measurements.—Total length, 3.8; tail vert., 1.6; hind foot, 0.46.

Description.—Upper parts sepia brown, under parts ashy gray, tail bicolor, upper portion and tip similar to back, under portion lighter. Summer caught specimens are lighter and brighter in color than those taken in winter.

The skull is small and rather slender, palate narrow and arched, anterior part of rostrum compressed and attenuate, unicuspid decreasing in size from first to fifth (viewed from the side they are sometimes in pairs, first and second subequal, and third and fourth subequal). The smaller size and the fact that the third unicuspid is larger than the fourth distinguish this species from *S. obscurus* and *dobsoni*; and the latter characteristic and profile of skull sloping from rear to rostrum distinguish it from *nanus*.

Distribution.—The Masked Shrew is found throughout the northern part of North America from Alaska and the Arctic Region south to the Rocky Mountains of Colorado, the Cascade, and Sierra Nevadas. It is an inhabitant of the colder portions only, coming as low as the Transition Zone. In Colorado it is found through the mountains and seems to be fairly common. It has been reported from El Paso, Chaffee, Gunnison, Garfield, and Boulder counties.

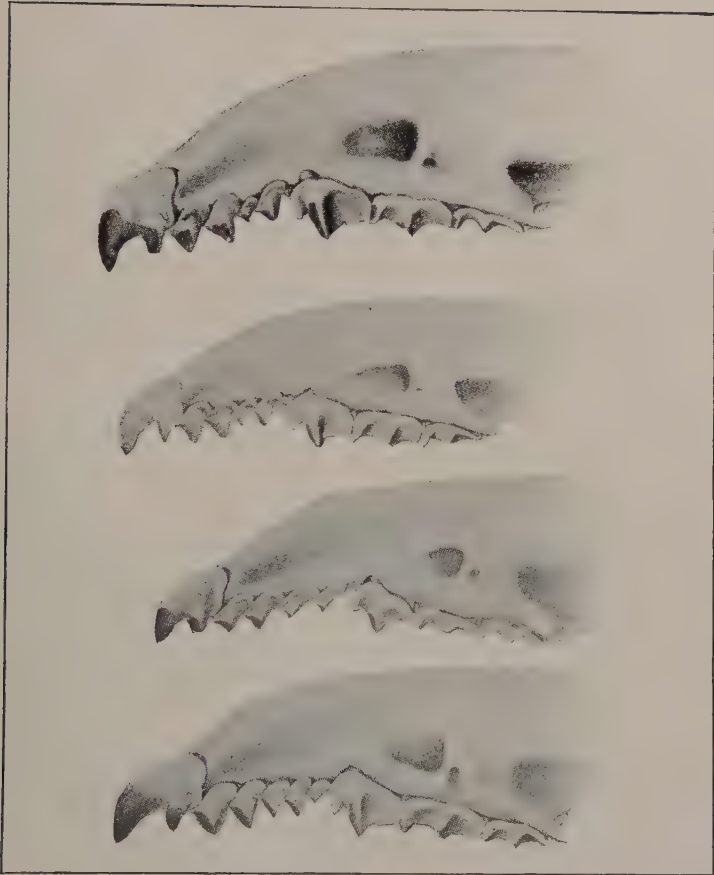


FIG. 79. UPPER JAWS AND TEETH OF SHREWS

1. *Sorex obscurus*. 2. *Sorex tenellus nanus*. 3. *Sorex personatus*.
4. *Sorex vagrans dobsoni*

Enlarged eight times. After Merriam

It has been taken nearly to 11,000 feet, and I have seen a shrew of some species at 12,000 feet. While this book has been in press I have identified specimens from the Summit House on Pike's Peak, 14,147 feet altitude.

Habits.—All the shrews of this genus are much alike in their

habits. They live about meadows and damp places, in the grass; also among fallen and rotten logs in the timber. They live on insects of various kinds, and being, in spite of their small size, very savage little animals, also kill small mice. Dr. Merriam once confined three of them under a large glass tumbler, and first two attacked the other, and killed and ate it, and after a little one of the survivors killed and ate the other! This all took place within eight hours. They breed during the spring and summer, and have from four to eight young. Five were found in a female taken July 15th, at Mud Springs, Garfield County.

Sorex vagrans dobsoni (Lat. *vagus*, wandering; *dobsoni*, for Dr. C. E. Dobson).

Sorex dobsoni Merriam, *N. A. Fauna*, No. 5, pp. 33-34 (1891).

Type locality.—Saw-tooth, or Alturas Lake, east base of Saw-tooth Mountains, Idaho.

Measurements.—Total length, 4.35; tail vert., 1.6; hind foot, 0.5.

Description.—"Upper parts uniform dull sepia brown with a faint chestnut tinge; under parts ashy gray, washed with drab; tail bicolor, dark brown above, drab below. In winter pelage the upper parts are iron gray or ash gray with very little sepia, and the under parts are white or nearly white." Merriam.

Skull medium size; palate of moderate width; anterior part of rostrum rather attenuate; unicuspid series narrow.

Distribution.—Dobson's Shrew is found in the mountains of Idaho, Montana, Wyoming, Utah, and Colorado. In the latter State we have only one record, Lake Moraine, El Paso County.

Sorex obscurus (Lat. dark, dusky). Dusky Shrew

Sorex obscurus Merriam, *N. A. Fauna*, No. 10, p. 72 (1895).

Sorex vagrans similis Merriam, *N. A. Fauna*, No. 5, pp. 34-35 (1891).

Type locality.—Timber Creek, Salmon River Mountains, Idaho. (Altitude 8,200 feet.)

Measurements.—Total length, 4.25; tail vert., 1.85; hind foot, 0.5.

Description.—In summer, upper parts dull sepia brown, under parts ashy, tinged with sepia; in winter the upper parts are ash gray and under parts ashy whitish; in either pelage the tail is bicolor, the upper portion like back, under part lighter, whitish.

Skull rather large, with broad palate; brain-case long as well as broad; unicuspidate teeth broad; third unicuspid decidedly smaller than fourth. This species has smaller ears, broader palate, and broader unicuspidate teeth than *S. dobsoni*. The molariform teeth are also larger.

Distribution.—Mountains of British Columbia, Washington, Montana, Wyoming, Utah, and Colorado, and south in the high Sierras to Mount Whitney, California. Preble took it in British America as far north as Fort Simpson, Lat. 62°. In Colorado it is found through much of the mountains, and has been reported from Long's Peak, Boulder, Nederland, Fort Garland, Cochetopa Pass, Silverton, Black Hawk, Crested Butte, Salida, Poncha Pass; several points in the mountains near Colorado Springs, and Marvine Lodge (Rio Blanco County). It has been taken as high as 11,500 feet, and down to 7,000 feet.



FIG. 80. DUSKY SHREW, *Sorex obscurus*

Photographed from a dead specimen by E. R. Warren

***Sorex tenellus nanus*. Dwarf Shrew**

Sorex tenellus nanus Merriam, *N. A. Fauna*, No. 10, p. 81 (1895).

Type locality.—Estes Park, Larimer County, Colorado (Coll. by E. A. Preble, Aug. 3, 1895).

Measurements.—Total length, 4.12; tail vert., 1.65; hind foot, 0.43.

Description.—Upper parts sepia brown, darkest on back; under parts and feet grayish ash; tail bicolor, upper side concolor with back, under side whitish. Skull small, slender, and very flat, the brain-

case being depressed to plane of rostrum; palate narrow. The small flat skull distinguishes this species from the other three thus far recorded from Colorado. The species which approaches it nearest in size, *S. personatus*, has a slightly longer hind foot and has the third unicuspid tooth larger than the fourth instead of *vice versa* as in case of *nanus*.

Distribution.—The Dwarf Shrew has been reported from Montana and Colorado only. In the latter State it has been taken at Estes Park, Westcliffe, and near Colorado Springs, between 7,000 and 8,000 feet elevation.

Genus NEOSOREX (Grk. *neos*, new + *sorex*)

Neosorex Baird, *Mammals N. Am.*, p. 11 (1857). Type *Neosorex navigator* Baird.

Revision, Merriam, *N. A. Fauna*, No. 10 (1895).

Shrews of large size, with long tails; feet large and fringed with bristle-like hairs; brain-case broad; mandible lightly built and slender.

These animals are found usually about water, and are of semi-aquatic habits. This genus is confined to North America, being found in the Sierra Nevadas of California, the Rocky Mountains from Colorado northward, and the boreal parts of eastern North America from plains of North Saskatchewan to Minnesota, northern Pennsylvania, the Adirondacks of New York, northern New England, and eastern Canada on both sides of the St. Lawrence, and one species in Alaska. Elliot's Check-list gives five species and subspecies, one of which inhabits Colorado.

Neosorex navigator (Lat. a sailor). Water Shrew

Neosorex navigator Baird, *Mamm. N. Am.*, pp. 11-12 (1857).

Type locality.—Unknown, probably northern Idaho.

Measurements.—Total length, 6.25; tail vert., 3; hind foot, 0.55.

Description.—Upper parts plumbeous, finely mixed with hoary; under parts silvery white; tail bicolor, dusky above and all around at tip, white below. Skull large; brain-case high, sloping from behind forward; palate rather broad; first and second unicuspidate teeth about equal in size; third and fourth also about same size but much smaller than first two.

Distribution.—The Water Shrew is found from Lat. 54° N.

south through the Rocky Mountains in British Columbia, Idaho, Montana, Wyoming, Utah, Colorado, and in the Sierra Nevadas in California. It is found in the Colorado mountains, and has been taken at Gold Hill, Cochetopa Pass, Boulder, Black Hawk, Crested Butte, Lake Moraine, and Coventry, the range in elevation being from 7,000 to over 10,000 feet.

Habits.—The Water Shrew, as its name would indicate, is found mostly about water, along the shores of streams and ponds, and is as much at home in the water as on land, swimming well. Its food is the same as that of the other species. I know nothing as to its breeding habits.

ORDER CHIROPTERA

This order contains the Bats, mammals with the fore limbs modified for flight; the bones of the arms and the fingers are enormously elongated and support a flying membrane, the patagium; the ulna is rudimentary, the radius is long and curved, the wrist consists of six carpal bones supporting a short thumb (pollex) which is always free from the wing membrane and always bears a claw; the other four fingers are greatly elongated, and it is between these, the sides of the body, the hind limbs, and tail that the wing membrane is extended; the knee joint is directed outwards and somewhat backwards, owing to the rotation of the hind limb outward toward the wing membrane; from the inner side of the ankle joint arises a peculiar cartilaginous process (the calcar) directed inward along the interior margin of the accessory membrane of flight extending between the legs and usually embracing the tail (the interfemoral membrane), a small lobe of this membrane on the outer side of the calcar often present is termed the post-calcarian lobe; another small portion of the wing membrane lying in front between the humerus and the radius is called the ante-brachial membrane; the ears which are often very large frequently have within the conch a peculiar upstanding process,

the tragus, whilst the portion of the outer margin of the conch opposite the tragus is called the antitragus.

Other important characters are as follows: testes abdominal or inguinal; penis pendant; mammary glands thoracic and generally post-axillary; uterus simple or with more or less long cornua; placenta discoidal and deciduate; the smooth cerebral hemispheres not extending backwards over the cerebellum.

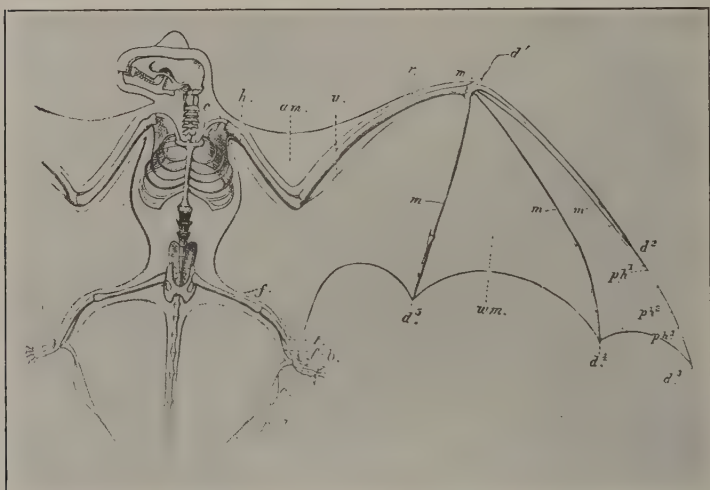


FIG. 81. SKELETON AND FLYING MEMBRANES OF A BAT

c, clavicle; *h*, humerus; *r*, radius; *u*, ulna (rudimentary); *d*¹, pollex, *d*², *d*³, *d*⁴, *d*⁵, digits; 2 to 5 supporting *w**m*, the wing membrane; *m*, *m*, metacarpal bones; *ph*¹, *ph*², *ph*³, first, second, and third phalanges; *am*, antebrachial membrane; *f*, femur; *t*, tibia; *f.b*, fibula (rudimentary); *c*, calcar, supporting *im*, the interfemoral membrane; *pcl*, postcalcaneal lobe. (From Flower and Lydekker)

The dental series includes incisors, canines, premolars and molars and never exceeds $i. \frac{2}{3}$; $c. \frac{1}{1}$; $pm. \frac{3}{3}$; $m. \frac{3}{3} \times 2 = 38$.

Bats are usually divided into two suborders, one, the *Megachiroptera*, containing only one family, the *Pteropidæ*

or Fruit-eating Bats, distinguished by the possession of a claw to the second digit as well as to the pollex, the other, the *Microchiroptera*, containing the other five families. In Colorado, however, we have representatives of only two families, both belonging to the Insect-eating Bats or *Microchiroptera*.

Habits of Bats.—Bats are nocturnal and crepuscular, appearing only towards dusk, and rarely seen flying during the day. During the day they hide in caves, crevices in rocks, in or about buildings, or in the branches of trees, suspending themselves by the hind feet and hanging head downward. The Colorado species are insectivorous, but there is a group of bats, usually of very large size, which subsists entirely or nearly so on fruit. Besides these there are bats which have a mixed diet of fruit and insects, and in South America are found the noted Vampire Bats, which live by sucking the blood of animals, and have their digestive apparatus greatly modified, the œsophagus being very narrow, and the stomach slender and intestine-like.

Some species at least of the bats are supposed to migrate at the approach of cold weather, while others seem to hibernate, but at present but little seems to be known on the subject. A. H. Howell, in *Proc. Biol. Soc. Wash.*, xxi., p. 35 (1908), speaks of seeing bats flying over a suburb of Washington, D. C., Sept. 28, 1907, between 9 and 10 A.M. During this time over a hundred bats were noted, all flying with the wind, which was southwest. They did not fly in flocks but singly. They were at height estimated as varying from 150 to 400 feet above the ground, which distance made it quite impossible to identify the species, though with a field glass it could be seen that there were at least three sizes represented. See also beyond under *Myotis californicus*.

The flight is usually erratic, the animals twisting and turning in every direction in pursuit of their prey, the night-flying insects. This peculiarity of flight makes it rather

difficult for the collector to shoot them. The power of flight varies nearly as much in bats as in birds, those with long narrow wings being swifter than the short-winged species; the stronger flying forms are apt to appear earlier in the evening than the others.

Bats are endowed with a strong tactile sense, or something more than that, as they can note and avoid obstacles without contact; this sense seems to be in the wing-membranes, and possibly in the large ears and nose leaf, a curious complicated organ highly developed in some families. Spazzani proved the existence of this sense by blinding bats, and letting them fly about a room across which many silk threads had been tied; they successfully avoided all contact with these threads though only space enough had been left between for them to pass with outstretched wings.

The breeding season of bats is in the summer, and but one or two young are brought forth, as a rule. The young spends its infancy clinging to the under side of its mother.

KEY OF THE COLORADO FAMILIES AND GENERA OF BATS

A. Tail not projecting beyond interfemoral membrane, but entirely enclosed within it (*Vespertilionidæ*).

a. Lower incisors, 6.

a'. Ears separate and smaller, moderate in size.

a". Upper incisors, 4; mammæ, 2.

a'''. Upper premolars, 6. Species all small, total length varying from 3 to 4; forearm, 1.25 to 1.60; tail long; ears narrow, in one species quite long; form slender; color mostly some shade of brown.

Myotis, p. 271

b'''. Upper premolars, 4; size small, length 4 or less.

a'''. Lower premolars, 6. Size larger, length 4 or less; forearm, 1.6; color very dark with silvery-tipped hairs; back of interfemoral membrane furred on basal third.

Lasionycteris, p. 276

b'''. Lower premolars, 4. Size very small, length, 3 or less; forearm, 1.2; color pale; back of interfemoral membrane sprinkled with hair on basal third.

Pipistrellus, p. 277

- c'' Upper premolars, 2. Skull large with very broad rostrum, and, in adult, with conspicuous sagittal crest; back of interfemoral membrane wholly naked except for a sprinkling of hairs on basal fourth; color brown; size quite large, length, 4.5; forearm, 1.75-1.9. **Eptesicus**, p. 278
- b''. Upper incisors, 2; upper premolars, 4. Dorsal surface of interfemoral membrane furred to nearly extreme edge; size large, length, 4.3-5.5; forearm, 1.6-2.0; mammæ, 4. **Nycteris**, p. 280
- b'. Ears very large, and joined at inner margin; length about 4; forearm, 1.65. **Corynorhinus**, p. 282
- b. Lower incisors, 4. Ears quite large and wide apart at base; color pale; size moderately large, length, 4.3; forearm, 2. **Antrozous**, p. 283
- B. Posterior third or more of tail projecting beyond and free from interfemoral membrane (*Molossidæ*).
Nyctinomus, p. 285

Family VESPERTILIONIDÆ

These are insectivorous bats with the nostrils placed at the extremity of the muzzle and opening by simple circular or crescentic apertures, with moderate-sized ears, usually separated, with well-developed tragi; legs short, tail long, contained in and produced to the hinder margin of the interfemoral membrane, with only the extreme tip occasionally projecting.

Incisors $\frac{1 \text{ or } 2}{3}$ on either side, upper ones small, separated by a wide space in the middle line, usually close to the canines; upper premolars one to three in number, when the latter the anterior tooth is usually small and often outside or inside the regular tooth row. This family is found nearly all over the world and contains by far the greatest number of species and individuals in the order.

Genus MYOTIS (Grk. *mus*, mouse + *otis*, ear, mouse-eared)

Myotis Kaup, *Skizzirte Entw.-Gesch. u. Natürl. Syst. d. Europ. Thierw.*, i., p. 106 (*myotis*) (1829). Type, *Vespertilio myotis* Bechstein.

Revision, Miller, *N. A. Fauna*, No. 13 (1897).

Skull slender and slightly built, without special peculiarities of form; the rostrum nearly as long as brain-case; the depth of the brain-case including auditory bullæ about equal to mastoid breadth; sagittal crest low, but usually distinct; palate deeply emarginate in front, abruptly contracted behind, the sides of its posterior extension parallel. Auditory bullæ well developed, but simple in form, and not very large. Ear well developed, slender, occasionally rather large; tragus slender and nearly or quite straight. Tail about as long as outstretched leg. Dentition, i. $\frac{2}{5}$; c. $\frac{1}{1}$; pm. $\frac{3}{5}$; m. $\frac{2}{5}$; $\times 2 = 38$.

The North American members of the genus *Myotis* are all small delicately formed bats, which, aside from their dental formula, shared by no other American genus of *Vespertilionidæ*, are usually recognized by their slender forms, long tails, hairy faces, narrow ears, and tapering straight or recurved tragi.

The genus *Myotis* has a geographical distribution covering the entire mainland of the Eastern and Western Hemispheres to the limits of tree growth; also the Malay Archipelago, New Guinea, Australia, and Samoa, and in America the Lesser Antilles. About eighty species are now known, of which fourteen, further subdivided to form twenty-three subspecies, are reported from North America, and of these six species and subspecies have been met with in Colorado.

KEY OF THE SPECIES

- A. Ear when laid forward extending less than 0.25 beyond nostril.
 - a. General color whitish gray or yellowish brown.
 - a'. Hind foot, 0.3 to 0.4; forearm, 1.3; color whitish gray, membranes pale dusky. **M. yumanensis**, p. 273
 - b'. Hind foot, 0.2 to 0.26; forearm, 1.3; color whitish gray or pale yellowish brown; membranes dark. **M. c. ciliolabrum**, p. 275
 - b. General color never whitish gray.
 - a'. Forearm, 1.15 to 1.37; color light yellowish gray or brown. **M. californicus**, p. 274
 - b'. Forearm, 1.15 to 1.60; species averaging larger than under a'.
 - a". Ear and tragus slender, the latter 0.35 or more in length; color light brown; forearm, 1.35. **M. subulatus**, p. 275

b". Ear and tragus short and broad, the latter 0.31 or less in length; color brown, darkest of the Colorado species. **M. l. longicrus**, p. 273

B. Ear when laid forward extending 0.25 to 0.4 beyond nostril; color light yellowish brown. **M. evotis**, p. 276

Myotis lucifugus longicrus (Lat. *lucifugus*, shunning light or daylight; *longus*, long + *crus*, the lower leg). Little Brown Bat.

Vespertilio longicrus True, *Science*, viii., p. 588 (1886).

Type locality.—Puget Sound.

Measurements.—Total length, 3.9; tail vert., 1.75; hind foot, 0.31; forearm, 1.5; length of skull, 0.55; width, 0.35.

Description.—(From a specimen taken at Twining, New Mexico, Aug. 1st): Above dark brown; under parts paler, with grayish cast; base of hair above and below blackish; ears and membranes look blackish, though brown by transmitted light.

The skull is characterized by broad muzzle and palate and gradually sloping forehead; the brain-case is broad and inflated at the back, less so in front. The skull differs from that of *M. subulatus* in its slightly smaller size, broader palate and muzzle, and less abruptly elevated face line (Miller). This is the largest species of *Myotis* found in Colorado.

Distribution.—Miller, *l. c.*, gives the distribution of this bat as being in the Boreal and Transition zones from Puget Sound east to Wyoming; south at least to Arizona and southern California. Miller records it from Grand Junction, and I have taken it near Herard P. O., Saguache County, 8,700 feet, and also have a bat from Medano Ranch, Costilla County, which resembles *longicrus* but differs in some respects and is as yet unidentified.

Myotis yumanensis (named for the type locality). Fort Yuma Bat.

Vespertilio yumanensis H. Allen, *Monogr: N. Am. Bats*, p. 58 (1864).

Type locality.—Old Fort Yuma, California.

Measurements.—Total length, 3.15; tail vert., 1.14; hind foot, 0.35; forearm, 1.3. Length of skull, 0.50; width, 0.33.

Description.—(From a specimen taken at Del Rio, Texas, May 26, 1903): Above a very pale yellowish brown; below grayish white. Membranes and ears pale brown.

Skull is like that of *M. l. longicrus* in form, but is smaller, and has shorter broader palate. It can be distinguished from that

of *M. californicus* by its slightly larger size and very much broader, more robust form, the nostrum in particular being noticeably broader. This is the palest of the Colorado species of *Myotis*.

Distribution.—Austral zones and lower edges of Transition Zone from southeastern United States to San Luis Potosi and Michoacan, Mexico (Miller l. c.). In Colorado it has been taken by Carey on Snake River south of Sunny Peak, and at Lely, both localities in Routt County.

***Myotis californicus.* California Bat**

Vesperugo californicus Aud. and Bach., *Journ. Acad. Nat. Sci. Phila.*, p. 280 (1842).

Type locality.—California.

Measurements.—Total length, 3.15; tail vert., 1.3; hind feet, 0.20; forearm, 1.25. Length of skull, 0.5; width, 0.28.

Description.—From a specimen taken at Santa Rosa, New Mexico, May 27, 1903: Intertympanic membrane furred on basal third; color above light brown (Miller says light yellowish gray), below paler and more grayish; ears and membranes blackish. Skull is smaller and more lightly built than that of any other Colorado *Myotis*. Brain-case moderately rounded, and the long narrow muscle fades gradually into the gently sloping forehead, and is thus very different from that of *M. jamaicensis*; the zygomata are widely expanded.

Distribution.—Austral zones and lower part of Transition Zone throughout the western United States and Lower California, east to Wyoming and Texas (Miller l. c.). There is a specimen in the collection of the Biological Survey, taken seven miles east of Antonio, Conchos County, at 8,000 feet. I have taken it at Bedrock, Montrose County, at 5,150 feet, and at Van Andert's Spring, Little Fountain Creek, El Paso County. Frey has taken it at Salina, Chaffee County, 7,000 feet.

Habits.—Mr. Junius Henderson has lately given me some interesting information concerning two bats of this species which were found by him and Mr. J. J. Blanchard in the Marchioness tunnel in Boukier Cañon, at an elevation of 6,200 feet. These bats, which were both females, were found in the tunnel, 350 feet from the entrance, beyond the frost line, December 22, 1900, and were apparently dormant when found. One recovered sufficiently when brought indoors to fly about the room, the other lay quietly but

breathing heavily until killed for the purpose of preserving it. Mr. Blanchard states that he has frequently found bats in tunnels and that the tunnels in which they are found are always dry; that he has never found them in wet ones. The temperature at this point was 46° F. This is the only record of which I have any knowledge of the occurrence in winter or hibernation of bats in Colorado. These two specimens are now in the Museum of the State University, of which Mr. Henderson is Curator and it is by his permission that I am permitted to publish these notes.

Myotis californicus ciliolabrum (Lat. *cilia*, eyelash, thence hair - *labrum*, lip). Hairy-Lipped Bat.

Vesperugo ciliolabrum Merriam, *Proc. Biol. Soc. Wash.*, iv., p. 1 (1886).

Type locality.—Trego County, Kansas.

Measurements.—Total length, 3.00; tail vert., 1.4; hind foot, 0.3; forearm, 1.30.

Description.—(From a specimen taken near Sunny Peak, Routt County, Colorado, Aug. 28, 1906): Basal portion of interfemoral membrane thinly haired; color above very pale yellowish brown (Miller calls it pale yellowish white); below pale whitish gray. All hairs plumbeous at base. Ears and membranes blackish. The pale color is the only character which distinguishes this form from *M. californicus*; next to *M. yumanensis* it is the palest of the Colorado species of *Myotis*.

Distribution.—The distribution of this subspecies is not very well known. Its range seemingly extends from Trego County, Kansas, and central South Dakota westward. In Colorado Cary took it a few miles southeast of Sunny Peak, in Routt County.

Myotis subulatus (Lat. *subula*, awl; in zoöl., slender, more or less cylindrical and tapering to a point). Say's Bat.

Vesperugo subulatus Say, *Long's Expedition to the Rocky Mountains*, ii., p. 65, footnote (1823).

Type locality.—Arkansas River, near La Junta, Colorado.

Measurements.—Total length, 3.25; tail vert., 1.50; hind foot, 0.30; forearm, 1.35.

Description.—(From a specimen taken near Colorado Springs):

Above, dull, rather pale brown; under parts whitish gray; ears blackish; membranes brown. Skull resembles that of *M. evotis* so closely that it is practically impossible to distinguish between the two except that that of *M. subulatus* is very slightly smaller.

Distribution.—North America east of the Rocky Mountains (Miller *l. c.*). The only Colorado records at present seem to be near La Junta (the type locality), and Colorado Springs.

Myotis evotis (Grk., *eu*, ear + *otis*, ear, well-eared).

Long-Eared Bat.

Vespertilio evotis H. Allen, *Monogr. Bats N. Am.*, p. 48 (1864).

Type locality.—Not stated and no type designated in original description. Miller says Monterey, Cal. (one of the localities given by Allen), may be selected as the type locality.

Measurements.—Total length, 3.5; tail vert., 1.7; hind foot, 0.32; ear from notch (dried skin), 0.65; forearm, 1.5. Length of skull, 0.55; width, 0.4.

Description.—(From specimen taken in Montezuma County, Colorado, June 20, 1907): Color above, light yellowish brown; below, paler and grayer; ears and membranes blackish. Skull larger than any other Colorado *Myotis* except *longicrus*, but is much slenderer than that, rostrum narrower, forehead very greatly sloping; brain-case noticeably narrower in front than behind, and flatter. The large ears distinguish it from any other of the species of *Myotis* found in Colorado.

Distribution.—Austral and Transition Zones from the Pacific coast to the eastern edge of the Rocky Mountains; south to Vera Cruz (Miller *l. c.*). He records specimens from Loveland, and Cary has taken it in western Montezuma County; Coventry, Montrose County, 6,800 feet, C. H. Smith.

Genus LASIONYCTERIS (Grk. *lasios*, shaggy, hairy, *nukteros*, nocturnal).

Lasionycteris Peters, *Montasber. k. preuss. Akad. Wissensch.*, Berlin, p. 648 (1865). Type, *Vespertilio noctivagans* LeConte.

Revision, Miller, *N. A. Fauna*, No. 13 (1897).

Skull flattened, rostrum very broad in proportion to brain-case. Strongly concave on each side back of the nasal aperture; dorsal profile of skull nearly straight and sloping gradually from external nares to occiput, which is scarcely angular, and always without sagittal crest. Ears short, nearly as broad as long; when laid forward reaching barely to nostril; basal lobe very large; tragus short, straight, and bluntly rounded at tip; width much more than

half length of anterior margin. Back of interfemoral membrane furred on basal half. Mammæ 2. Dentition, i. $\frac{2}{3}$; c. $\frac{1}{1}$; pm. $\frac{2}{3}$; m. $\frac{2}{3} \times 2 = 36$.

Small dark-colored bats, represented only by the type species which is distributed from northern North America south through the United States, and has been taken at several localities in Colorado.

Lasionycteris noctivagans (Lat. *nox*, night, *vagans*, to wander). Silver-Haired Bat.

Vespertilio noctivagans LeConte, McMurtrie's *Cuvier's Animal Kingdom*, i., p. 31 (1831).

Type locality.—Eastern United States.

Measurements.—Total length, 3.75; tail vert., 1.5; hind foot, 0.37; forearm, 1.6. Length of skull, 0.55; width, 0.35.

Description.—(From a specimen taken in Garfield County, July 13th): Fur on both back and under parts deep blackish chocolate brown, many of the hairs on back and belly tipped with silvery white, but these white tips are absent from head and throat. Membranes blackish.

Cranial and dental characters as for genus. The very dark color, with silvery tipped hairs distinguishes it from all other species of bats occurring in Colorado.

Distribution.—North America, from Atlantic to Pacific; probably not breeding south of the Transition Zone (Miller *l. c.*). Preble reports it as far north as Lat. 56°. Miller records it from Rifle; it has also been taken at Greeley (Beardsley, Hall); Florida, La Plata Co. (Rowley); near Colorado Springs (Sclater); West Fork, Elk Creek, eight miles above New Castle, and Green Mountain Falls (Warren); Salida (Frey); Boulder (in Museum of University of Colorado).

Genus PIPISTRELLUS (*pipistrelle*, the name of a European Bat)

Pipistrellus Kaup, *Skizzirte Entwick.: Gesch., u. Natürl. Syst. d. Europ. Thierw.*, Th. i., 98 (1829). Type, *Vespertilio pipistrellus* Schreber.

Revision, Miller, *N. A. Fauna*, No. 13 (1897).

Skull small and lightly built, varying somewhat in form among the different species; brain-case usually more inflated than in *Vespertilio* and *Lasionycteris*, but rostrum proportionally as broad as in these genera. Ears distinctly longer than broad, and tapering

to a narrowly rounding tip; tragus straight or slightly curved forward. Back of interfemoral membrane sprinkled with hair on basal third. Mammæ 2. Dentition, i. $\frac{2}{3}$; c. $\frac{1}{1}$; pm. $\frac{2}{3}$; m. $\frac{2}{3} \times 2 = 34$.

The members of this genus are all small, some of them the smallest of known bats. About forty species are now recognized in the genus; these are found on the entire mainland of the Eastern Hemisphere to the limits of tree growth, and also in the Malay Archipelago, New Guinea, Solomon Islands, and northern Australia; in America from the northern United States (except in the Boreal Zone) to southern Mexico. Of these forty species four species and three subspecies are found in North and Middle America, and one, *P. hesperus*, has been taken in Colorado.

Pipistrellus hesperus (Lat. the evening star). Western Bat

Scotophilus hesperus H. Allen, *Monogr. N. Am. Bats*, p. 43 (1864).

Type locality.—Fort Yuma, California.

Measurements.—Total length, 3.0; tail vert., 1.2; hind foot, 0.2; forearm, 1.20. Length of skull, 0.42; width, 0.3.

Description.—(From a specimen taken at Fort Bowie, Arizona, May 21st): Color above and below light yellowish gray, hairs plumbeous at base; ears, muzzle, face, and membranes black.

Cranial and dental characters as for genus. The anterior upper premolar is very minute and usually thrown out of tooth row by the second premolar. The very small size distinguishes it from all other Colorado bats.

Distribution.—Lower Austral Zone in the western United States from western Texas to the Pacific Coast. Limits not known (Miller *l. c.*). He records it from Grand Junction and I have taken it at Bedrock, on the Dolores River in Montrose County, 5,150 feet.

Genus EPTESICUS

Eptesicus Rafinesque, *Annals of Nature*, p. 2 (1820). Type, *Vespertilio fuscus* Beauvois.

Revision, Miller, *N. A. Fauna*, No. 13 (1897).

Skull large and heavily built, rostrum broad in proportion to brain-case, scarcely concave at sides back of nasal aperture; dorsal profile nearly straight, rising gradually from external nares to occiput, which in the adult is strongly angular and provided with a conspicuous sagittal crest. Ears short, considerably narrower than

long, basal lobe well developed, but not excessively large; tragus straight, short, directed slightly forward, broadest near the middle and tapering to a moderately sharp point. Back of interfemoral membrane wholly naked, except for a sprinkling of hairs on basal fourth. Mammæ 2. Dentition, i. $\frac{2}{3}$; c. $\frac{1}{1}$; pm. $\frac{1}{2}$; m. $\frac{2}{3} \times 2 = 32$.

About 45 species are known in this genus, found in Africa, Madagascar, Australia, Asia (except Malay Region), America from southern Canada southward (except Lesser Antilles). Two species, with eight subspecies, are found in North and Middle America and West Indies, of which two are found in Colorado and are among the largest of our bats.

KEY OF THE SPECIES

- A. Color brown, moderately dark; size smaller than B; length about 4.5; forearm, 1.75. **E. fuscus**, p. 279
 B. Color brownish ashy above, pale gray below; size larger, length, 4.9; forearm, 1.9. **E. pallidus**, p. 280

Eptesicus fuscus (Lat. dark, dusky). Brown Bat

Vespertilio fuscus Beauvois, *Catal. Peale's Mus.*, p. 14 (1796).

Type locality.—Philadelphia, Pennsylvania.

Measurements.—Total length, 4.5; tail vert., 1.75; hind foot, 0.4; forearm, 1.75. Length of skull, 0.7; width, 0.5.

Description.—(From a specimen taken at Colorado Springs, Aug. 4th): Dark brown on back; paler, rather grayish on under parts; ears and membranes blackish.

Cranial and dental characters as for genus.

Excepting the two species of *Nycteris* this and the next species are the largest Colorado bats, and it may easily be distinguished from them by its brown color and the practically naked dorsal surface of the interfemoral membrane.

Distribution.—Austral, Transition and (lower edge of) Boreal zones throughout the United States and adjoining British Provinces (Miller, *l. c.*). He records it from Loveland. Other Colorado localities are Greeley (Beardsley); Florida, La Plata Co. (Rowley); Colorado Springs, Douglas Spring, Routt County, Newcastle (Warren).

Habits.—J. W. Frey and myself took twenty-one specimens of this species at Newcastle in rather a peculiar manner. We had been told that there were a lot of bats behind the shutters

on a building in the town. The building was a two story brick one with a flat roof, and had iron shutters at each window, intended to be closed in case of fire, but usually fastened back against the side of the building. Going to the roof and looking over, a number of bats could be seen behind one of the second story shutters, and one or two behind others. How to get them was the question, and it was solved by tying three fish hooks together, and to the end of a line, and then Frey went fishing while I held the bag, in this case a big pocket handkerchief. The fisherman proved an expert and hauled up bat after bat; not one got away from behind that shutter, though one or two did from others. When the game had been chloroformed and counted, there were twenty-one Brown Bats and four Mexican Free-tailed Bats. Of these twenty-one Brown Bats twenty were females and only one was a male. One of the females had a naked blind young one clinging to its body. This was on July 16th. The specimen noted under distribution as being taken at Douglas Spring was captured June 24th, and contained a single good-sized embryo.

Eptesicus pallidus(Lat. pale). Young's Bat

Eptesicus pallidus Young, *Proc. Acad. Nat. Sci. Phila.*, pp. 408-409 (1908).

Type locality.—Boulder, Colorado.

Measurements.—Total length, 4.9; tail vert., 1.95; hind foot, 0.45; forearm, 1.9.

Description.—Brownish ashy above, basal half of hairs fuscous; below pale silvery gray, with basal half of hairs fuscous. The colors are very decidedly paler than those of any specimen of *E. fuscus* in my collection, though those latter vary considerably among themselves.

The skull is identical with that of *E. fuscus*.

Genus NYCTERIS

Nycteris Borkhausen, *Dcr. Zool.* (Comp. Bibliothek. gemm. Kentn f. a. Stände, pt. xxi.), Heft iv.-vii., p. 66 (1797). Type, *Vespertilio noveboracensis* Erxleben = *N. borealis*.

Revision, Miller, *N. A. Fauna*, No. 13 (1897). (There called *Lasiurus*.)

Skull broad, short, and deep, very different in form from that of any of the other genera of bats found in Colorado; brain-case high and rounded, the rostrum sloping away rapidly in front so that its upper surface is nearly in line with that of brain-case. Palate sloping upward anteriorly, and floor of brain-case rising posteriorly so that the two surfaces are set at noticeably different angles. Ear short, rounded. Interfemoral membrane very large, most of its upper surface furred. Mammaræ four, the only genus having this number.

Dentition, i. $\frac{1}{1}$; c. $\frac{1}{1}$; pm. $\frac{2}{2}$; m. $\frac{3}{3} \times 2 = 32$; anterior upper premolar at base of canine on inner side.

The members of this genus are recognizable among North American Bats by their thickly furred interfemoral membranes.

About a dozen forms are now recognized, distributed in America to the limits of tree growth, including the Bahama Islands and Greater Antilles; also the Galapagos and Hawaiian Islands. Of these two species have been met with in Colorado.

KEY OF THE SPECIES

- A. Size large, forearm more than 2.0; color brown, hairs tipped with silvery white. **N. cinereus**, p. 282
- B. Smaller, forearm, 1.5; color reddish. **N. borealis**, p. 281

Nycteris borealis (Lat. *Boreas*, the god of the North Wind). Red Bat.

Vespertilio borealis Müller, *Natur. Syst.*, Suppl., p. 21 (1776).

Lasiurus borealis Warren, *Mamm. of Colo.*, p. 268 (1906).

Type locality.—New York.

Measurements.—Total length, 4.3; tail vert., 2.0; hind foot, 0.8; forearm, 1.60. Length of skull, 0.5; width, 0.35.

Description.—(Compiled from Miller): Fur everywhere full and soft, covering whole dorsal surface of interfemoral membrane: the color varies much, ranging from bright rufous red or fawn color to yellowish gray; red specimens are rufous red throughout, paler and more fawn colored on belly; the hairs of the back usually with distinct grayish tips, these on throat and chest tipped with whitish.

Gray specimens are yellowish gray on the back and buffy on the belly.

Cranial and dental characters as for genus.

Distribution.—The Red Bat is found throughout eastern North America from Canada to Florida and Texas and westwards to Colorado. It has only one record from the State, at Greeley, by Beardsley.

Nycteris cinereus. Hoary Bat

Vespertilio linereus Palisot de Beauvois, *Catal. Peale's Mus.*, Phila., p. 14 (1796). (Obvious misprint for *cinereus*.)

Lasiurus cinereus Warren, *Mamm. of Colo.*, p. 268 (1906).

Type locality.—Philadelphia, Pennsylvania.

Measurements.—Total length, 5.3; tail vert., 2.25; hind foot, 0.4; forearm, 2.0; length of skull, 0.65; width, 0.5.

Description.—(From specimen taken at Delavan, Wisconsin, July 6, 1901): Yellowish brown on head; umber brown on back and interfemoral membrane, hairs tipped with silvery white, sometimes nearly concealing the dark tint underneath; under parts paler brown, with whitish tipped hairs on belly; membranes blackish.

Skull similar to that of *N. borealis*, but very much larger, in proportion to the difference in size between the two species.

The minute upper premolar is proportionally smaller than in *N. borealis*. The combination of large size, long tail, and hoary color at once distinguishes this from all other Colorado bats.

Distribution.—The Hoary Bat ranges throughout the northern portion of America from Lat. 55° southwards. In Colorado it has been met with in Larimer County (Miller); Grand Junction (Bradbury); Boulder (Rohwer, Bergtold); Salida (Frey).

Genus CORYNORHINUS (Grk. *korunc*, a club + *rhis*, nose)

Corynorhinus H. Allen, *Proc. Acad. Nat. Sci. Phila.*, p. 173 (1865). Type, *Plecotus macrotis* LeConte.

Revision, Miller, *N. A. Fauna*, No. 13 (1897).

Ears very large, much longer than head, close together and joined across the forehead; region between eye and nostril occupied by a prominent thickened ridge which terminates in a conspicuous club-shaped enlargement. Skull slender and highly arched; the rostral portion relatively smaller than in any other North American genus of *Vespertilionidae*. Dentition, i. $\frac{3}{3}$; c. $\frac{1}{1}$; pm. $\frac{3}{3}$; m. $\frac{3}{3} \times 2 = 36$.

Found in the warmer parts of North America from southern

British Columbia and the southeastern United States to southern Mexico. The genus contains one species, which is subdivided into three subspecies, one of which has been taken in Colorado.

Corynorhinus macrotis pallescens (Grk. *makros*, large + *otis*, ear; *pallescens*, Lat. to grow pale). Pale Big-eared Bat.

Corynorhinus macrotis pallescens Miller, *N. A. Fauna*, No. 13, p. 52 (1897).

Type locality.—Kearney Cañon, Navajo County, Arizona (A. K. Fisher, Aug. 3, 1894).

Measurements.—Total length, 3.85; tail vert., 1.8; hind foot, 0.4; ear from notch (dried skin), 1.1; forearm, 1.65. Length of skull, 0.6; width, 0.35.

Description.—(From a specimen taken at Oro Grande, California, March 15th. B. S. No. 136, 230): Above pale, somewhat yellowish brown, lighter on head; under parts much paler, grayish rather than brown; ears and membranes light brown.

Cranial and dental characters as for genus.

The very large ears distinguish it from all our other bats, except *A. pacificus*, and they are larger than those of that species, besides being close together at the base.

Distribution.—Probably throughout the Austral zones from California, Colorado, and western Texas to Southern Mexico (Miller, *l. c.*). He reports it from Larimer County. Other Colorado records are Trinidad (Beardsley); Fort Collins (Johnson); Crisman, Boulder County, 7,000 feet (Henderson).

Genus ANTROZOUS (Grk. *antron*, a cave + *zoön*, animal)

Antrozous H. Allen, *Proc. Acad. Nat. Sci. Phila.*, p. 247 (1862). Type, *Vespertilio pallidus* LeConte.

Revision, Miller, *N. A. Fauna*, No. 13 (1897).

Muzzle squarely truncate, with low but distinct horseshoe shaped ridge above nostrils; behind this a large flattish swelling on each side. Ears separate, but large, wide apart at base, extending considerably beyond tip of muzzle when laid forward; tragus long and slender, straight. Skull with rather high smooth braincase, deep interorbital region, and large rostrum, the dorsal profile with no special concavities or convexities. Dentition, i. $\frac{1}{2}$; c. $\frac{1}{4}$; pm. $\frac{1}{2}$; m. $\frac{3}{8} \times 2 = 28$; teeth large and strong; upper premolar

transversely long and narrow; first lower premolar small and closely wedged between canines and second premolar.

Among American *Vespertilionidæ* this genus is at once recognizable by the form of the muzzle. The known species are all of large size for the group, and their color is a characteristic pallid tawny.

The genus is found in the warmer parts of western North America, from Texas to the Pacific coast, and from the Columbia River to Central Mexico. Of the three known forms one has been taken in southern Colorado.

Antrozous pallidus. Pale Bat

Vespertilio pallidus LeConte, *Proc. Acad. Nat. Sci. Phila.*, vii., p. 437 (1854-55).

Type locality.—El Paso, Texas.

Measurements.—Total length, 4.4; tail vert., 1.75; hind foot, 0.4; ear from notch, dried skin, 0.9; forearm, 2. Length of skull, 0.75; width, 0.5.

Description.—(From a specimen taken in Montezuma County, June 21, 1903): Hairs above very pale yellowish, almost white, and tipped with pale brown; under parts grayish white; ears similar to back; membranes blackish. Skull and cranial characters as for genus.

The only Colorado species likely to be confused with it is *Corynorhinus m. pallescens*, and the much paler color and smaller ears of the present species besides the cranial and dental characters distinguish it.

Distribution.—Desert region of eastern California. Nevada, Arizona, New Mexico, southern Colorado, and western Texas. There are two records from Colorado, Pueblo (Coues and Yarrow), and Ashbaugh's Ranch, Montezuma County (Cary).

Family MOLOSSIDÆ

Insectivorous Bats with simple nostrils at the end of the muzzle; ears variable in size and form, sometimes joined across the forehead, tragus much reduced, antitragus large; first phalanx of the middle finger in repose folded on the

dorsal or upper surface of the metacarpal bone; membranes thick and leathery; fibula complete, bowed outwards from the tibia and forming an important part of the mechanism of the leg; interfemoral membrane short, the tail projecting conspicuously beyond its free edge.

Genus NYCTINOMUS

Nyctinomus Geoffroy, *Descr. de l'Égypte*, ii., p. 114 (1813). Type, *Nyctinomus ægypticus* Geoffroy.

Skull with rounded or somewhat flattened moderately wide brain-case, about one and one third times as long as rostrum, above level of which it is very slightly elevated, and at least half as deep as wide. Sagittal crest scarcely indicated. Ears large and rounded, arising from same point on forehead. Laid forward they extend distinctly beyond extremity of muzzle; anterior border of ear conch with six to eight horny excrescences; keel well developed; tragus small, flattened, squarely truncate above. Muzzle pad well developed, sharply outlined, its upper margin thickly set with horny points like those on anterior margin of ear; a line of similar points extends downwards across middle of pad between nostrils. Upper lip full and wrinkled, rather thickly sprinkled, as are also the muzzle and chin, with stiffened spoon-hairs, the extremities of which are slightly expanded. Posterior third or more of tail extending beyond interfemoral membrane. This latter character distinguishes this genus from all other genera of bats found in Colorado.

About forty species of *Nyctinomus* are now recognized, which are found in the warmer portions of both hemispheres, north to southern Europe and the southern United States, east of the Philippines and Norfolk Island; eleven species occur in North and Middle America and the West Indies, and two have been taken in Colorado.

KEY OF THE SPECIES

- A. Smaller, forearm, 1.75; color dull sooty brown; ears moderate in size. **N. mexicanus**, p. 285
- B. Larger, forearm, 2.4; color dark umber brown; ears large and rounded. **N. depressus**, p. 286

Nyctinomus mexicanus. Mexican Free-tailed Bat

Nyctinomus mexicanus Sauss., *Rev. Mag. Zool.*, 2me Ser., xii., p. 283 (1860).

Type locality.—Cofre de Perote, State of Vera Cruz, Mexico, 13,000 feet elevation.

Measurements.—Total length, 4.0; tail vert., 1.45; free part of tail, 0.50; hind foot, 0.4; forearm, 1.75. Length of skull, 0.62; width, 0.4.

Description.—(From a specimen taken at Newcastle, Garfield County, Colorado, July 16th): Upper parts a dull sooty looking brown; below paler and grayer. Ears and membranes dull blackish. The ears are large and squarish; the posterior third or more of the tail is free from the membrane. Skull: rostrum broad and flat; brain-case elevated behind, but flat on central and anterior portions: zygoma not expanded.

Distribution.—Volcano of Popocatepetl, through Mexico to California and Colorado. Also found in Lower California. At present the only Colorado record is Newcastle (Warren).

Habits.—The only specimens of this species at present known from Colorado were taken by Warren and Frey, under circumstances described under *Eptesicus fuscus*.

Nyctinomus depressus (Lat. depressed). Tucubaya
Free-tailed Bat.

Nyctinomus depressus Ward, *Am. Nat.*, xxv., p. 747 (1891).

Type locality.—Tucubaya, a suburb of the City of Mexico.

Measurements.—(Taken from dried specimen): Total length, about 4.25; tail vert., about 1.7; hind foot, 0.4; forearm, 2.4.

Description.—(From a specimen taken at Grand Junction, Colorado): Upper parts rather dark umber brown in color, under parts quite similar but duller; ears blackish, large, and rounded. Wing membranes brown. Skull much longer than in case of *N. mexicanus* and narrower in proportion; sloping but little from behind to front; canines long and prominent.

Distribution.—This bat has only been recorded, to my knowledge, from the type locality, Mexico City, Mexico; California, Arizona, Nevada, and Colorado, there being only one record for each of the last four. The Colorado specimen was taken at Grand Junction by S. M. Bradbury.

GLOSSARY

Bicolor, having two colors.

Bicuspid, having two cusps.

Brachyodont, having a short or low crown; applied to the teeth of the *Cervidæ*.

Bulla, pl. *bullæ*, the inflated portion of the bony part of the external meatus of the ear.

Canine, the teeth between the incisors and molars, usually conical in shape, wanting in rodents.

Carnassial, the large cutting teeth of Carnivora; last upper premolar and first lower molar in *Canidæ* and *Felidæ*.

Carpus, the collection of bones at the end of the forearm, forming the wrist joint.

Centrale, a bone situated in the middle of the typical carpus and tarsus, often wanting.

Clavicle, the collar bone.

Conch, the external ear.

Condyle, a protuberance on the end of a bone, serving to form an articulation with another bone.

Coronoid process, a projection or process on the lower jaw which gives insertion to the temporal muscle; coronoid means resembling the beak of a crow.

Crepuscular, coming out or active at twilight.

Cusp, any prominence or protuberance of the crown of a tooth.

Deciduous, shed at certain times, either periodically, or once in the life of an animal, as in the case of certain teeth.

Dichotomously, dividing by subdivision into two parts or pairs.

Digitigrade, walking on the toes.

Diurnal, active by day.

Dorsal, belonging to the back.

Emargination, having the margin cut away or into.

Entepicondylar foramen, a foramen near the condyle of the humerus and which transmits a nerve.

Fauna, the animals of a country or district.

Foramen, plural *foramina*, a hole or opening, usually in a bone.

Fossorial, digging and living in burrows.

Hallux, the first toe of the hind foot, the big toe in man.

Hibernate, to spend the winter in a state of torpidity.

Humerus, the upper bone of the fore limb.

Hypsodont, having long crowns and short roots, applied to such teeth as the molars of the *Bovidæ*.

Incisors, the teeth in the front part of the mouth, always in front of the canines when the latter are present.

Incisiform, having a cutting shape or form.

Interfemoral, between the thighs, used with reference to that part of the wing membrane of a bat which is between the two hind legs.

Interorbital, between the eyes or orbits.

Lambdoidal ridge, the ridge extending around the upper part of the back of the skull of a mammal; not always well-developed.

Mandible, the lower jaw.

Mastoid capsules, the outer posterior portion of the mastoid, in some mammals considerably inflated.

Meatus, an opening, in this book used exclusively with reference to the ear, sometimes spoken of as the *auditory meatus*.

Molariform, having the shape or form of a molar.

Molars, the grinding teeth, always in the back of the mouth.

Nares (plural), the nostrils.

Nocturnal, active by night.

Omnivorous, eating or living on any sort of food.

Orbit, the eye socket.

Plage, the hair or fur of a mammal, used in the same sense as the plumage of a bird.

Pencilled, *pencillated*, referring to the tail ending in a distinct tuft of longer hairs.

Phalanges, the bones of the fingers or toes.

Plantigrade, walking on the whole sole of the foot.

Pollex, the thumb or first toe of front foot.

Postauricular, behind the ear.

Postorbital, behind the orbit or eye, especially those processes of the skull which lie or project back of the eye.

Premolar, a tooth in the permanent dentition which replaces the milk molar.

Radius, the outer of the two bones of the fore leg.

Ramus, pl. *rami*, the ascending branch of the lower jaw.

Reëntrant, used especially with reference to the angles on the sides of the molars of certain rodents, and which extend into the body of the tooth.

Retractile, capable of being drawn back or in, as the claws of a cat.

Rostrum, that part of the skull anterior to the eyes, practically the nose.

Sagittal crest, a ridge or crest on the upper surface of the brain-case of a mammal; not always present.

Salient, projecting outward; the opposite of reëntrant.

Sectorial, cutting, or adapted therefor.

Septum, a partition.

Sulcate, grooved.

Supraorbital, over or above the orbit or eyes.

Tarsus, the collection of bones below the tibia and forming the ankle joint connecting the foot to the leg.

Tibia, the large bone of the leg below the knee.

Tragus, an erect process within the conch or external ear of a bat.

Tricuspid, having three cusps.

Truncate, blunt.

Tuberculate, having tubercles, or little projections or swellings.

Tympanic, pertaining to the ear drum or tympanum.

Ulna, the inner of the two bones of the fore leg between the elbow and the wrist.

Unicuspid, *unicuspidate*, having a single cusp.

Zygoma, the bony arch of the cheek, formed by the malar or jugal bone and its connections.

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